RAILROAD GAZETTE

FRIDAY, MAY 11, 1900.

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Contributions.

The Railroads of China.

To the Editor of the Railroad Gazette:

Noting your remark in issue of April 27, page 277, under caption "Railroads in China" that you were unable to find "Kiakhta" on the map. There are better maps of the district in question, but if you have no other accessible, please refer to Rand-McNally's atlas for 1900, page 421. Southeast of Irkutsk you will find on the border line between Mongolia and Siberia two towns shown on opposite sides of the border line; on the Mongolian side Maimachen, on the Siberian side Troitz Kossavsk; the latter is "Kiakhta." By treaty between Russia and China, 1859-1860, Russia acquired the right to maintain at its own expense a postal service between Kiakhta and Tientsin via Urga, which is the chief station on this great tea highway between Kiakhta and Kalgan (Gateway in the Great Wall). For further information please see "The Earth and Its Inhabitants," volumes on "Asia," which are indexed.

A READER.

"The Earth and Its Inhabitants.—Asia—The city which guards the frontier in the Selanga basin has long enjoyed a monopoly of the trade with China. In 1728, after the conclusion of a treaty of peace between the two empires, the two factories of the Russian and Chinese traders were founded at a distance of 650 feet from each other. In the south was Mai-mei-chen (Maimachin), or the 'Chinese Mart"; in the north Kiakhta, commanded by the fortified Cossack station. . . . In the intervening space between the two towns the Chinese have disposed large planks in the form of a screen, to protect their dwellings form the baleful influences of the Russian atmosphere, and on this screen was formerly painted the character meaning 'good luck.' Thus every noxious breath from Kiakhta and every profane expression utered by the Russians was stopped half way, and driven back to the desert. . . . Kiakhta is the most populous place in Transbaikailia, and the richest in all East Siberia."

The "Barschall" Joint.

New York, May 5, 1900.

To the Editor of Railroad Gazette:

Referring to the article in your issue of May 4th—"The Superstructure of the Vienna Railroad"—from a lecture by Hugo Koestler, Chief Engineer of the Vienna Railroad, I beg to inform you that the joint referred to is known throughout Europe as the "Stossfangschiene," and in this country was named by some of the Pennsylvania Company's officers the "Barschall joint." The joint was awarded a premium by the Union of German Railroad Administrations, in 1896. The entire line of the Vienna Railroad is equipped with it, while in this country the Pennsylvania has been testing it for the past two years on about 25 miles. Other roads having used it to more or less extent for some years are the Prussian, Austrian, Hungarian, Russian, Swedish and Danish State Railroads, as well as the Kaiser Ferdinand Nordbahn, Austrian Southern, Bushterahder, Kaschau-Oderberger, Swiss Central, Mediterranean and Meridionale Railroad, etc.

It is a radical departure in principle from all joints in use to date, being thoroughly independent of the main rail. This accounts for the smooth and noiseless riding, and lack of hammering and flattening of the rail ends, so that the maximum life of the rail is attained, the wear being equal throughout its entire length. The cost of maintenance is reduced about 30 per cent. Practical experience has shown that this joint, applied to worn rail ends, gives the rail an increase of several years' life, and costs about 10 per cent. of the renewal, thus saving several years 90 per cent of the outlay of capital to renew rails.

The joint is particularly adapted for electric railroads, owing to the inexpensive and fully protected bonding in the hollow space between filler and main rail, and can be applied to any rail.

M. BARSCHALL.

Railroad Engineering at Columbia University.

New York, May 4, 1900.

To the Editor of the Railroad Gazette:

Judging from a short article in your issue of March 2 and a communication produced by it in your issue of March 16, both of the current year, I am led to believe that some of the friends of the Department of Civil Engineering at Columbia University, who are even its next-door neighbors, so to speak, fail to appreciate just what it is doing, and if that is the case much more do a great many others, whose means of observation are more limited, probably fail to realize the full scope of the course of Civil Engineering at Columbia. It seems to me, therefore, only a matter of simple justice to that Department, in view of the publications mentioned above, that some features of the course as now administered should be made known through your very excellent journal.

This impresses me especially in view of the fact that the Department under consideration is not given to much advertising of the impressionist type. It seems to me to be a little more professional, if not in better taste, and probably ultimately more effective, if the quiet and substantial work of the Department be left chiefly to speak for itself, much as the character of the individual will be best exhibited in the coloring of his own career. The communications in question relate particularly to the subject of railroad engineering, which constitutes a very important portion of the field of the Civil Engineer. The problem of transportation, including all structures, motive power, rolling stock, and all the means which contribute to the interchange of people and commodities, belong peculiarly and wholly to the profession of the Civil Engineer, and any impression which may find lodgment in the minds of those who read the Railroad Gazette that the course in railroad engineering at Columbia is less comprehensive than that justified by the preceding observation is in error.

It is not meant by this statement that the whole subject of railroad engineering and administration has yet been developed to such a complete and perfect state that no further development will take place in the future, because it is the purpose of the management of the Department of Civil Engineering at Columbia that no year shall pass by without every subject given in it, either in laboratory or lecture, being substantially advanced beyond the condition in which the previous year had found it. At the present time the special work of railroad engineering begins in the third year of the course and extends through both that and the fourth year. Unusually thorough and comprehensive lectures on railroad surveying, with practical treatment of the questions or problems involved, extend through the entire third year, and during the summer vacation between the third and fourth years complete railroad surveys from the reconnoissance to the contract are made, including all the operations pursued in railroad surveys and construction in a country of very diversified topography.

During the entire fourth year the same degree of thoroughness characterizes the study of railroad engineering. This work, however, is of a more advanced character and covers the problems not only of economics of location, operation and maintenance, estimates, specifications, contracts, track, switch and signal work, but also buildings, structures and organization. It is a great mistake to suppose that the studies in this subject do not rise above "the line of the rails." As a matter of fact, they rise far enough above that elevation to include all the main problems of operation and organization. Indeed, the construction and maintenance of the roadbed and track are but portions, although essential portions, of the whole subject of railroad engineering as given in the Department of Civil Enginering. The design of locomotives and other portions of the rolling stock, simply as machines, is naturally found in the Department of Mechanical Engineering, but the economic operation of the locomotive and other rolling stock, their control and administration so as to secure maximum efficiency with the greatest return to the stockholders, as employed in the business of railroading, are wholly and in every detail treated in the Department of Civil Engineering.

I desire particularly to emphasize these points so that there may be no misapprehension as to the scope of railroad engineering as studied and taught at Columbia. The broad questions of organization and administration are studied and developed as distinct and essential parts of the educational equipment of every civil engineer. The location of Columbia University is such as to give it exceptional facilities for contact with the technical and administrative features of railroad engineering in its most comprehensve sense, and it is the purpose of the administration of the Department of Civil Engineering to avail itself of all these opportunities which this specially favored environment offers, not only in railroad work, but in the many other branches of civil engineering.

It is not irrelevant in this place to speak further and briefly of the general scope of the course in civil engineering. The comprehensive treatment which characterizes railroad work in that Department is found characteristic of all its subjects. Indeed, the course in civil engineering at Columbia is based on the broad principle that civil engineering is all engineering not military and naval, that it is "the art of directing the great sources of power in nature to the convenience and use of man." No better definition of Civil Engineering than that which is found in the Charter of the Institution of Civil Engineers of Great Britain has ever yet been written, and it never will be. Civil Engineering at Columbia is not a mere narrow matter of statics. The course of study is so constructed and administered as to meet the requirements of civil engineering in its broadest and best sense as set forth in the terse and forcible definition given above. It is intended to make no narrow specialist of any man who pursues it, but to give him a thorough educational equipment in those technical subjects which will make him a thoroughly professional man, qualified to undertake those special lines of technical work after graduation for which his subsequent opportunities or his natural abilities may best fit him.

With this end in view, every subject is developed from the fundamental and general philosophical principles which underlie it to its direct application in practical engineering matters. There are no subjects in what may be termed pictorial engineering in this day of lantern slides (the bane, if not the curse, pardon the word, of engineering instruction at the present time) in which the dim and obscure illumination of the evanescent slide is so much relied upon to give a pleasing delusion to the unthinking observer. In short, the main characteristics of the course are well stated in the following quotation from a University publication:

"It (the course in civil engineering) covers comprehensively the subjects of surveying, road and railroad engineering, water supplies of cities and towns, irrigation, sanitary engineering, including sewage disposal; both graphic and analytic treatment of all metallic structures, foundations, fetaining and reservoir walls, high masonry dams, sewer systems, hydraulic engineering, rivers and harbors, pumping engines, hydraulic, steam and electric motors," for which abundant laboratories are provided as well as lecture-room work.

WM. H. BURR.

Standard Specifications for Materials.

[WITH AN INSET.]

The American Section of the International Association for Testing Materials has taken up its work in an elaborate and systematic manner, and this week we begin the publication of a number of important tables, giving synopses of proposed specifications. We shall continue from time to time the publication of these tables and also of the text of the specifications proposed.

The Executive Committee of the American Section recently approved of the plan of asking the national engineering societies in the United States to take up these specifications for discussion. The American Society of Civil Engineers will discuss certain specifications on May 16, and the American Society of Mechanical Engineers will discuss these and others at its meeting in Cincinnati, May 15 to 17. This week we publish, by abstract, the specifications to be discussed by the Civil Engineers.

The third annual meeting of the American Section will be held in New York City, Oct. 25 to 27, when six sessions will probably be held, four of which will be devoted to the detailed discussion of these specifications. Meantime, they will be put in the hands of many engineers by direct distribution from the headquarters of the American Section, and by publication in the Railroad Gazette, and by the societies, and the committee hopes that valuable suggestions will be received from those who are interested in the matter. It is considered of the utmost importance that the views of all those interested should be secured in order that the final discussion in October may be adequate and conclusive.

With this article appear three tables, giving synopses of the proposed specifications, viz.: Rolled Steel, Wrought Iron and Hull Material. Every intelligent reader will appreciate the difficulties of making such tables accurate, where there must of necessity be several authors, editors and proofreaders, and information of typographical errors will be acceptable as well as technical discussion.

We publish these tables largely to aid the Association in this most important work, and shall be glad to publish discussion or comment that may be suggested or to forward it unpublished to the committee in charge.

The committee of the American Section now numbers 34 members, representing quite completely the manufacturing as well as the strictly professional side. The Chairman of the American section is Prof. Mansfield Merriman and the Chairman of Committee No. 1, which has compiled the specifications now made public, is Mr. W. R. Webster.

Structural Steel for Buildings.

This may be either open hearth or Bessemer, and shall not contain more than 0.10 per cent. of phosphorus. There shall be two classes, namely, rivet steel and medium steel. For rivet steel the tensile strength shall be 50,000 lbs. to 60,000 lbs. per sq in., and for medium steel both limits are 10,000 lbs. higher. The yield point is 30,000 and 35,000 lbs., respectively, and the elongation in eight inches is 26 per cent. and 22 per cent.

For material less than $\frac{5}{16}$ in. or more than $\frac{3}{4}$ in. thick, certain modifications are made in the requirements for elongation, namely, for each increase of $\frac{1}{8}$ over $\frac{3}{4}$, a deduction of one per cent. from the specified elongation, and for each decrease of $\frac{1}{16}$ under $\frac{5}{16}$ a deduction of 2½ per cent. For pins the required elongation shall be five per cent. less than that specified above.

Rivet steel shall bend cold 180 degrees flat on itself; medium steel 180 degrees around a diameter equal to the thickness of the specimen tested.

The standard test specimen of eight inches gaged length is carefully prescribed as to dimensions, with a sketch. A tension specimen shall be taken from the finished material of each melt or blow, but if this breaks outside of the middle third of its gaged length another test specimen may be taken. A bending specimen shall be taken from the finished material of each melt or blow and for material ¾ in. and less thick this specimen shall have the natural rolled surface on two opposite sides. Material not to be annealed shall be tested as it comes from the rolls. Material annealed or otherwise treated shall be so treated before cutting the tensile test specimen.

Permissible variations in weight or cross section are carefully specified.

Steel for Bridges and Ships.

This shall be made by the open hearth process. In acid steel the phosphorous shall not exceed 0.08, in basic 0.06. In either case the sulphur shall not exceed 0.06. There shall be three classes of structural steel for bridges and ships, namely, rivet steel, soft steel and medium steel. The tensile strength of the rivet steel shall be between 50,000 and 60,000 lbs. per sq. in.; soft steel, 52,000 to 62,000; medium steel, 60,000 to 70,000. The yield point for each of these classes shall be 30,000 lbs., 32,000 lbs. and 35,000 lbs. The elongation shall be 26 per cent., 25 and 22. For material less than $\frac{5}{16}$ in. thick or more than ¾ in. thick, modifications in the elongation requirements are made, as in case of steel for buildings.

I-bars shall be made of medium steel. Full size tests shall show 12½ per cent. elongation in 15 ft. Tensile strength shall not be less than 55,000 lbs., and I-bars must break in the body. Should an I-bar break in the head and show 12½ per cent. elongation in 15 ft. and 55,000 lbs. tensile strength it shall not be cause for rejection, provided that not more than one-third of the I-bars so tested break in the head.

The cold bending tests shall be 180 degrees flat on itself for rivet steel and soft steel; and on medium steel 180 degrees around a diameter equal to the thickness of the specimen tested.

The remarks made concerning steel for buildings apply also to the remaining clauses of the specifications for bridge and ship steel.

Wrought Iron.

Wrought iron shall be made by puddling or rolled from fagots or piles made up from No. 1 wrought iron scrap, alone or with muck bar added, it being understood that test iron Class B, and staybolt iron contain no scrap.

The minimum physical qualities required shall be:

	Refined iron.	Test iron Class A.	Test iron Class B.	Staybolt iron.
Tensile strength, lbs. per sq. in.	48,000	48,000	50,000	46,000
Yield point, lbs. per sq. in.	25,000	25,000	25,000	25,000
Elongation, per cent. in 8 in.	15	20	25	28

In sections weighing less than 0.654 lb. per lineal foot the percentage of elongation required in the four classes shall be 11.25 per cent., 15 per cent., 18.75 per cent., and 21 per cent. respectively.

The four classes when nicked and bent shall show the following fracture:

(a). Refined iron, fibrous, free from coarse crystalline spots. Not over 15 per cent. of the fractured surface shall be granular.

(b). Test iron Class A, fibrous, free from coarse crystalline spots. Not over 10 per cent. of the fractured surface shall be granular.

(c). Test iron Class B, a long, clean, silky fiber, free from slag or dirt or any coarse crystalline spots. A few fine crystalline spots may be tolerated provided they do not in the aggregate exceed 10 per cent. of the sectional area of the bar.

(a). Staybolt iron, a long, clean, silky fiber, free from slag or dirt, and wholly fibrous, being practically free from crystalline spots.

Refined iron shall bend cold 180 deg. around a diameter equal to twice the thickness of the specimen tested.

Test iron Class A, shall bend cold 180 deg. around a diameter equal to the thickness of the tested specimen.

Test iron Class B, shall bend cold 180 deg. flat on itself.

A piece of staybolt iron about 22 in. long shall bend in the middle through 180 deg. flat on itself, and then bend in the middle through 180 deg. flat on itself in a plane at a right angle to the former direction. Another specimen with a thread cut over the entire length shall stand this double bending without showing deep cracks in the threads.

The four classes of iron shall conform to the following hot bending tests:

Refined iron shall bend sharply to a right angle, without showing cracks or flaws.

Test iron Class A, shall bend through 180 deg. flat on itself, without showing cracks or flaws.

Test iron Class B, shall bend through 180 deg. flat on itself, without showing cracks or flaws. A similar specimen heated to a yellow heat and suddenly quenched in water between 80 deg. and 90 deg. F. shall bend, without hammering on the bend, 180 deg. flat on itself without showing cracks or flaws. A similar specimen heated to a bright red heat shall be split at the end and each part bent back through an angle of 180 deg. It will also be punched and expanded by drifts until a round hole is formed whose diameter is not less than nine-tenths of the diameter of the rod or width of the bar. Any extension of the original split or indications of fracture, cracks, or flaws developed by the above tests will be sufficient cause for the rejection of the lot represented by that rod or bar.

Staybolt iron shall bend through 180 deg. flat on itself, without showing cracks or flaws. A similar specimen heated to a yellow heat and suddenly quenched in water between 80 deg. and 90 deg. F. shall bend, without hammering on the bend, 180 deg. flat on itself without showing cracks or flaws.

Staybolt iron shall permit of the cutting of a clean sharp thread and be rolled true to gages desired, so as not to jam in the threading dies.

Whenever possible iron shall be tested in full size as rolled. In flats and shapes too large to test as rolled, the standard test specimen 1½ in. wide and 8-in. gaged length; in large rounds the standard test specimen of 2-in. gaged length shall be used; the center of this specimen shall be half way between the center and outside of the round. Sketches of these two standard test specimens are given.

Nicking tests shall be made on specimens cut from the iron as rolled. The specimen shall be slightly and evenly nicked on one side and bent back at this point through an angle of 180 deg. by a succession of light blows. Test iron Class B, and staybolt iron may be nicked approximately 20 per cent. of its thickness.

SYNOPSIS OF SPECIFICATIONS FOR HULL MATERIAL.

COMPILED FOR COMMITTEE NO. 1.—AMERICAN SECTION, INTERNATIONAL ASSOCIATION FOR TESTING MATERIALS.

Name and Date.	Quality of steel.	Chemistry. Phos. Maximum.	Chemistry. Sul. Maximum.	Physical Properties. Tensile stren'h lbs. per sq. in. Min.	Tensile stren'h lbs. per sq. in. Max.	Elastic limit, lbs. per sq. in.	Elongation, per cent.	Reduction of area, per cent.	Cold bend.	Quench Bend.	Punch tests.	Opening and closing tests for shapes.	Number of tensile tests.	Remarks.	Variation in weight, per cent. Sections.	Variation in weight, per cent. Entire order
American Bureau of Shipping, 1899.	Bess or O.H.	.....	.....	58,000	68,000	....	20	.....	.....	180° D = 3 × t	.....	Yes.	Two per melt.	Material over 68,000 lbs. T. S. will not be rejected if elongation increases proportionately.		
Americ'n Steel Barge Co., 1897	O. H.	.08	.....	52,000	62 000	....	24	45	.....	.....	.....	.....	.....	.....	2½ plts. und. 20 lbs. 5%.	2½
Pittsburg Steamship Co., 1899	Bess. O. H.	.10 .08	Shapes. Plates.	54,000	62,000	.....	24	45	.....	.....	.....	.....	.....	.....		Standard
American Ship Building Co , 1899	O. H.	.08 acid .04 basic	.....	52,000	60,000	.....	24	45	Per Lloyd's		.....	.....	.....	.....		2½
Detroit Dry Dock Co., 1897	O.H.	.075	.....	52,000	60,000	½ ult.	25	45	.....	180° D = 3 × t	Yes.	.....	One per melt.	.....	.....	2½
U. S. Steamship Owners, Builders & Underwriters' Assoc., 1900	Bess. or O.H.	.....	.....	56,000	66,000	.....	18	.....	.....	180° D = 1½ × t	Yes.	Yes.	.....	Pieces with undressed edges to bend C. or Q. 120° D = 1½ × t. All tests may be long'l or trans. for plates.		
Lloyds	.....	.....	.....	60,480	71,680	.....	20	.....	Yes.	180° D = 3 × t	.....	.....	One each lot of 50 or less.	El. may be 16 per cent. for mat'l ¼-in thick.		
Bureau Veritas	.....	.....	.....	62,720	71,680	.....	20	.....	.....	180° D = 3 × t	.....	Yes.	One each lot of 50 or less.			

Technical Instruction in Signaling.*

Few branches of mechanical engineering having such marked bearing upon the general welfare have shown such remarkable rapidity of development as that of signaling and interlocking. The subject is still in its infancy, but signals are now looked upon as an absolute necessity. The importance of this branch of railroad science is indicated by the rapid growth in membership of this Club, now enrolling 135 members and including a goodly number of signal engineers in its membership, a title almost unknown until a few years ago.

In such a growing field it is natural that there should be a demand for trained men to fill subordinate positions, and it is the province of the technical school to do what it can to supply efficient assistants who have had some special training for their work. This is being done now with more or less success by several schools. A course of instruction in this branch of railroading should in the first place be well grounded in mechanical engineering with enough electrical engineering to enable the student to master the principles of the application of electricity to signaling work. The course should go hand in hand with work in general railway mechanical engineering. A signal engineer should be first a good mechanical engineer; after that, he should know something of track, transportation, and of electrical engineering. It was thought in the early days of signaling that the work should be closely related to the Maintenance of Way Department. Now, however, the problem is, as it seems to me, largely one of mechanics and of transportation, and is fast becoming of sufficient importance to merit a departmental organization of its own.

Beginning, then, in this way the special instruction in signaling should be given in some such order as the following:

What Signaling Is for.
- The necessity for some form of signaling.
- How it accomplishes its purpose.
- Some of its fundamental and underlying principles.

Early History of Signaling.
- Primitive methods and how they have developed.

Present Methods of Train Dispatching.
- Train Order System—Double Order System.
- Typical Train Rules.

Block Signaling.
- Space interval vs. time interval.
- Forms and arrangements of signals used.
- Night signals. Best colors available.
- Normal danger vs. normal clear systems.

Telegraphic Manual Systems.
- Methods employed.

Controlled Manual Systems.
- Methods and apparatus.

Automatic Systems.
- Electric.
- Electro-pneumatic.

Interlocking.
- What it is for.
- The interlocking machine .
- Switch and locking movements.
- Pipe vs. wire connected signals.
- Other constructional details.

Pneumatic Interlocking.
- Apparatus; advantages.
- High pressure vs. low pressure.

Cost of Apparatus.
- First cost of different systems.
- Maintenance cost of different systems.

Organization of the Signal Department.
- As it is and as it should be.

The apparatus used should be illustrated in detail by the liberal use of the lantern, using, where possible, colored slides when showing views of semaphores, targets, etc. It should be the aim to give also the practical side of signaling work. The instructor in signaling must keep in touch with what is considered the best practice of the time.

The courses should not confine themselves to the class room; there should be exhibits of interlocking and signaling apparatus to which reference could be made. Trips of inspection should be made to neighboring plants, problems should be worked out.

*A paper read before the Railway Signaling Club at Chicago May 8, by R. A. Smart, M. E., Associate Professor of Experimental Engineering, Purdue University. Condensed.

such, for instance, as the design of locking mechanisms to fit particular crossings or junctions. Lectures should be given before the students occasionally by practical men in charge of signaling.

Men who have taken such a course of instruction should be able to fill subordinate positions more intelligently than those who have had no such training. The modern college graduate does not leave school expecting to sit in his office and superintend others. On the contrary, he is anxious and willing to find a place for the development of his abilities, even though this opportunity brings many years of hard work at the bottom of the ladder.

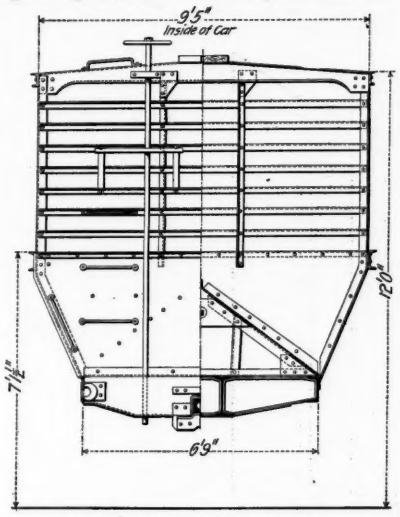
A Pressed Steel Coke Car.

The engravings show a coke car built for the Chicago, Lake Shore & Eastern Ry., by the Pressed Steel Car Co. This car is designed to carry a load of 80,000 lbs. The principal dimensions are as follows:

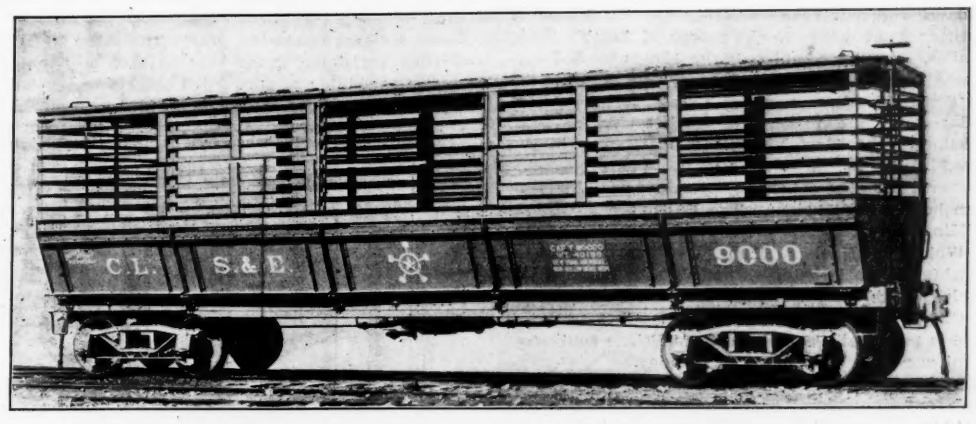
Length of car over end sills	40ft. 7¼in.
Length of car inside, in clear	39ft. 2 in.
Width of car over side sills	6ft. 9 in.
Width of car over eaves	9ft. 8⅛in.
Width of car, inside, in clear	9ft. 5 in.
Height of car from top of rail to eaves	12ft. 0 in.
Height of car from top of rail to top of running board	12ft. 5½in.

It will be observed that the Pressed Steel Car Company's diamond truck is used with 33-in. chilled wheels weighing 650 lbs. The journals are 5 in. x 9 in., with "universal" journal bearings. The solid pressed steel brake beam, as made by the Pressed Steel Car Co., is used and the Buckeye M. C. B. coupler.

The car is arranged to be loaded partly through slide doors on the side, the loading to be finished through hinged doors on the top of the car. It is unloaded through side doors which extend the full length on both sides of the car. All of these details are quite clearly shown in the various engravings. For the drawings and information we are indebted to Mr. Ackert, President and General Manager of the railroad company, and to the Pressed Steel Car Co.



End Elevation and Cross-Section.



A Steel Coke Car—Chicago, Lake Shore & Eastern Railway.

New Railroads in West Virginia.

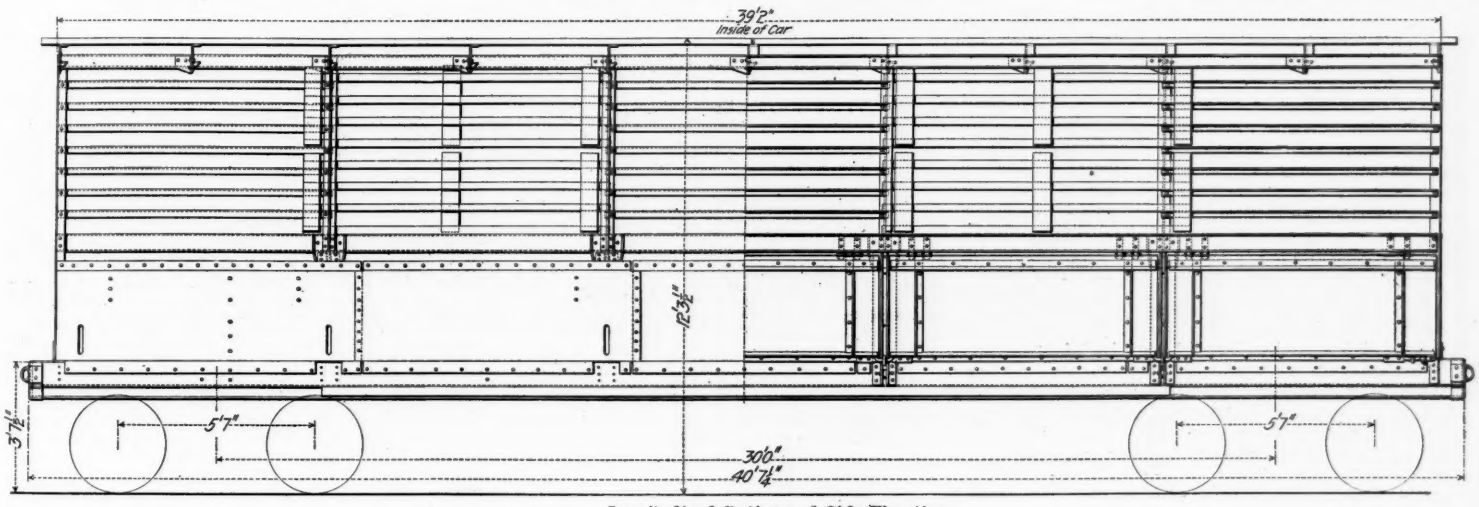
West Virginia is one of the most active states in railroad building this year. There are some twenty roads and extensions now building and the mileage under contract or construction aggregates nearly 500. Probably much of this road will not be completed this year; some of it may never be built. But if a tenth is finished it will exceed the yearly average added to the mileage of that state for the past four yars. West Virginia now has about 2,244 miles of railroad in operation, and 833 miles, or over one-third of this, has been added in the last nine years; an average of 92½ miles a year. But much the larger part of this addition was made from 1891 to 1895. The record year of recent times was 1892, during which 269 miles was completed. Last year there was 44 miles built, which is about the average of the past four four years.

Prominent among the new roads is the West Virginia Short Line, which is practically an extension of the Ohio River RR., and is to run from New Martinsville southeast 60 miles to Clarksburg, there to connect with the Baltimore & Ohio. Practically all the grading, tunnelling and bridging is completed and track laying is to be begun about May 1. The Morgantown & Kingwood is another new road in the northern part of the State. It is to run from Morgantown, on the Baltimore & Ohio, southeast 27 miles to Kingwood, on the West Virginia Northern, which is a short feeder to the Baltimore & Ohio main line. About 11 miles of track is laid and it is announced that the road is to be completed about July 1. Another road projected by the same interests is the Central RR. of West Virginia. It is to run from Morgantown, western terminus of the Morgantown & Kingwood, south about 65 miles to Belington, northern terminus of the West Virginia Central & Pittsburgh. Ten miles was graded at last report, and four miles of track laid.

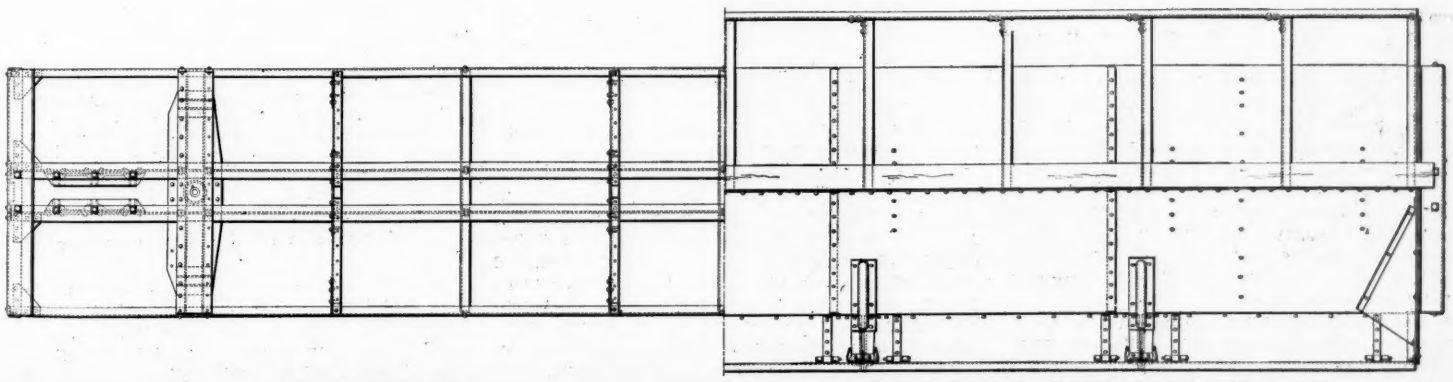
In this connection may be mentioned the extension of the West Virginia Central & Pittsburgh, for which the contract has just been let. It is to extend from Elkins south 43 miles to the Forks of Greenbrier River. There it will connect with the new Greenbrier branch of the Chesapeake & Ohio which is building from near Whitcomb, on the main line, to run northeast about 95 miles up the Greenbrier River through Marlinton to the Forks. About 50 miles of this latter road is graded, and six miles of track laid.

From Point Marion, Pa., near the West Virginia line, a road is building under the title of the Cheat Valley, southeast 73 miles up Cheat River to Parsons, W. Va., connecting with another branch of the West Virginia Central & Pittsburgh. Track was laid a year ago from Rowlesburg north eight miles and some grading has been done beyond.

Coming down toward the southern part of the State, we find the Guyandotte Valley RR. building from Huntington southeast 100 miles up the Guyandotte River to Pineville. The first 28 miles is under contract. The Deepwater is to run from Robson, on the Kanawha & Michigan, west 25 miles up Lower Loup Creek to Glen Jean. Some four miles is completed. Another new line is the Hinton, New River & Western from Pearisburg, Va., northwest about 140 miles via Hinton, W. Va., to Charleston. It is graded for several miles from Hinton and surveyed along the east side of Neco



Longitudinal Section and Side Elevation.



Plan of Underframe. *Horizontal Section and Plan of Roof Framing.*

Pressed Steel Coke Car—Chicago, Lake Shore & Eastern Railway.

River. For some time past the Holly River & Addison has been extending its line. It is to run from Palmer Junction, on a branch of the Baltimore & Ohio, southeast 31 miles to Addison. All but the last nine miles is completed.

Among the new roads building are the Iaeger & Southern from Iaeger to the mouth of Jacob's Fork, 26 miles, 4.6 miles completed; the Kanawha & Pocahontas from Dego on the Chesapeake & Ohio, to run south 15 miles up Paint Creek Valley to coal lands; and the Pickens & Hackers Valley from Pickens on the West Virginia & Pittsburgh to run west 15 miles to Hackers Valley.

Several of the older companies are building branches and extensions. The Baltimore & Ohio is building a branch in Barbour County from near Philippi down Hacker's Run. Its West Virginia & Pittsburgh line is being extended from Camden-on-Gauley south 9½ miles to a point near the mouth of Cherry River. A branch of the Chesapeake & Ohio is practically completed from Prince southwest 14 miles across New River to Beckley.

Besides these roads building there are some 40 more extensions and new lines, projected in the State, some of which are fairly certain to be built in part this year. Among the extensions of older companies are three or four proposed by the Baltimore & Ohio; others by the Philadelphia & Reading, the Pittsburgh, Virginia & Charleston line of the Pennsylvania, and by the Hocking Valley.

The reason for this revival of railroad building in West Virgina is probably to be found chiefly in the rapid development of the natural resources of the State. Twenty-five years ago Virginia was producing an average of from 25,000 to 30,000 gross tons of pig iron a year. This output had risen to 123,000 tons in 1890. After dropping again in 1891, it shot up to 155,000 tons in 1892, the high water mark until 1898. That year, 1892, was also the year of greatest new railroad activity. West Virginia has shared in the recent revival of the iron and steel industry. The production of 1898 was 192,700 tons, the largest in the history of the State; the output of last year was less by 5,000 tons .

There has been a similar growth in the coal industry. In 1875 West Virginia was producing about 800,000 gross tons of bituminous coal. In 1880 the output had risen to 1,800,000 and to 6,600,000 tons in 1890. Since then the State's output of coal has been expanding until it reached 13¾ million gross tons in 1898. West Virginia ranks third among the coal producing States, the position she has held since passing Ohio in 1896.

According to the report of the Interstate Commerce Commission for 1898, the latest issued, West Virginia has an average of 8.7 miles of railroad per 100 square miles of territory, and 24.25 miles per 10,000 population. There were 22 States better supplied in proportion to territory and 28 States and territories better supplied in proportion to population. These facts seem to indicate that in West Virginia there is still room for more railroads.

Performance of Heavy Freight Locomotives on the Union Pacific.

The eight twelve-wheel freight locomotives lately built for the Union Pacific by the Brooks Locomotive Works have now been in service about eight months, and are working satisfactorily on the Wyoming Division, between Ogden and Evanston. These stations are 76 miles apart, and the engraving shows the profile of that section of road for which the twelve-wheelers were designed. In building these locomotives it was intended that, as a maximum, trains of 750 tons, exclusive of the weight of the engine, tender and caboose, should be hauled from Ogden to Evanston in 5 hours, and the engines have actually exceeded this, hauling 756 tons in 4 hours and 15 minutes.

The result of using heavier motive-power is apparent from a comparison with the work done before the use of these twelve-wheelers, when this piece of road was worked with consolidation engines of the 1200 class. These consolidation engines have cylinders 20 x 24 in., drivers 51 in. in diameter, and working steam pressure 160 lbs., the weight on drivers being 90,000 lbs., and the total weight of the engine in working order 104,200 lbs. Eastbound from Ogden, 450 tons (cars and lading) was the load for one engine, and a pusher was used between Uintah and Devil's Gate Hill, where there are 5 miles of 90-ft. grade, and again a pusher was used from Echo to Wahsatch, where there are 8 miles of grade, 90 ft. to the mile. These trains made the run in about 5 hours. In the same way slower trains took 525 tons, while to haul 650 tons (cars and lading) in about 5 hours double-headers of class 1200 engines had to be used. In will be seen that the new twelve-wheeler make possible an increase of train load of about 70 per cent. and at the same time do away with two helping engines.

The new twelve-wheel locomotives are known as the 1500 class, and have 21 x 30-in. cylinders; 57-in. drivers; working steam pressure, 200 lbs.; weight on the drivers 165,000 lbs. The engine and tender in working order weigh 305,000 lbs. There are 34.8 sq. ft. of grate area, 2,750 sq. ft. of heating surface in the tubes, and 259 sq. ft. in the firebox, making a total heating surface of 3,009 sq. ft.

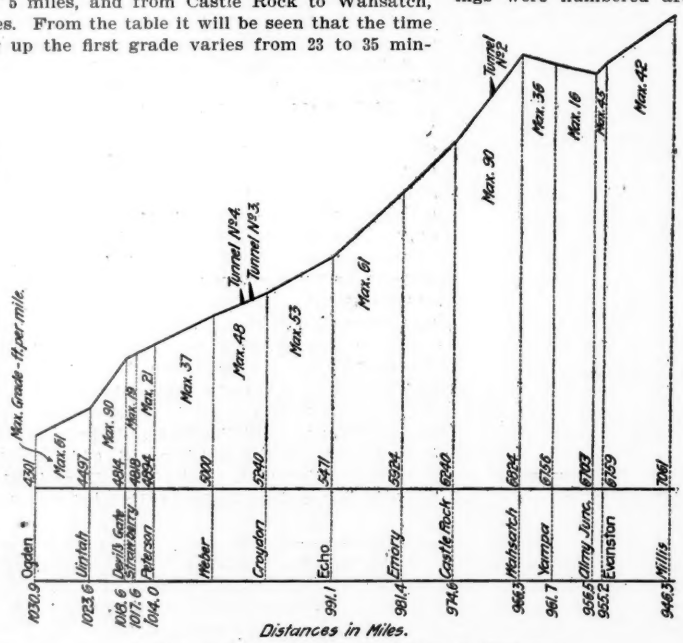
The performance of these engines is shown by the table compiled from the daily reports for March and April.

These are representative runs with trains of fruit and other perishable goods that have to be handled on a fast schedule and forwarded quickly as received from connecting lines at Ogden. It will be seen that in one case the 76-mile run was made in 3 hours and 50 minutes, which includes an unusual delay of 42 minutes; deducting this one stop makes the average speed between terminals about 24 miles an hour, which is a rather remarkable performance considering the grades and the train, which weighed 680 tons, exclusive of engine, tender and caboose. The work of these engines is also being closely watched on the sections formerly worked by helping engines, that is between Uintah and Devil's Gate, 5 miles, and from Castle Rock to Wahsatch, 8 miles. From the table it will be seen that the time going up the first grade varies from 23 to 35 minutes, corresponding to average speeds of 13 and 9 miles an hour, respectively. Between Castle Rock and Wahsatch the average speed is from 10 to 5 miles an hour.

Performance of twelve-wheel freight locomotives on the Union Pacific Ry., east bound, Ogden to Evanston—76 miles.

Date. 1900.	Number of— Loads.	Cars.	Train Tons.*	Time between Ogden and Evanston. hr. min.	Time going up grade. Uintah to Devil's Gate. min.	Castle Rock to Wahsatch. min.	Remarks.
Mch. 25.	25	25	756	4:15	28	51	
April 1.	20	20	662	4:20	28	45	
" 3.	22	22	715	5:57	35	64	
" 4.	21	21	689	4:33	28	45	
" 5.	20	24	714	6:15	32	60	
" 8.	21	21	680	3:50	27	46	Delayed 42 min. by other trains.
" 8.	23	23	686	5:35	33	45	Delayed 30 min. by other trains.
" 11.	21	21	669	4:59	24	36	Delayed 35 min. by other trains.
" 11.	23	23	727	6:25	33	91	
" 12.	23	23	734	5:50	25	54	Delayed 1 hr. 8 min. by other trains.
" 15.	21	21	678	4:25	23	45	
" 15.	22	22	702	4:35	25	59	
" 16.	21	21	694	4:45	24	55	
" 17.	20	20	692	4:40	26	56	

* Tons (2,000 lbs.) exclusive of engine, tender and caboose. Add 168 tons to get total tons.



Profile of the Union Pacific—Ogden to Evanston.

Railroad Preliminary Survey by Stadia.*

While making a preliminary survey for some 200 miles of railroad it was desired to make an economical location. The difficulty encountered was to reduce Wellington's theory to forms that could be intelligently and quickly applied in the field. This was accomplished by substituting known quantities for the particular line in question, using Mr. McHenry's instructions to engineers on the Northern Pacific line. Stadia surveys were considered, and we concluded that very accurate stadia lines would cost nearly as much as a two-instrument survey. Therefore, we ran at least one two-instrument survey over the entire line, then after a careful reconnoissance of all places in doubt, all lines that appeared favorable were investigated by a very rough and rapid stadia survey.

We had a solid combined rod and flag pole made, 10 ft. long and shod with a point, for setting tacks, also to stick in the ground and be left standing. While the man at the instrument was taking observations the rodman was taking the topography. As 600 ft. is about the limit of sight for a Philadelphia rod, we divided the rod to 0.02 of a foot, and succeeded in reading it to 0.01. The rod was 10 ft. long for convenience in handling, because the height of the instrument is nearly 5 ft., or the middle of the rod, and because the decimal divisions facilitate reading the rod from either end or from the middle.

In starting the survey we assumed a base line, preferably north and south, then read the azimuth of some fixed line, and also read the azimuth of each point of observation. When setting the instrument over a hub the course of procedure was to clamp the vernier where it was when the hub was set, transit the telescope and set on the last instrument hub. Observations were taken once only, the rodman leaving a lath at each hub, to mark the point and to be used as a back-sight.

The focal distance of the instrument and the vertical angle correction were eliminated except in special cases or with large angles. The vertical distance was taken direct with the telescops level, or the vertical angle recorded, and the vertical distance taken from a table of natural sines, with two decimals marked off. As the angles were all small, the table was carried on a card in a note book.

All instrument points were numbered successively, and marked as such. Intermediate and side readings were numbered after each instrument point. The elevation of each hub is the algebraic sum of the vertical distances between the hubs, and the intermediate elevations were filled in later from their respective hubs. The sum distance between hubs gives the profile stations, and the stations of the intermediate readings on the line are filled in. The nature of the grade-line can be seen at any time in the field by inspecting the notes, and the profile of the day's work can be easily made in the evening.

The topography is taken by the rodman. He takes the contour notes directly from observation with the hand level, + for up, and — for down. His notes show the horizontal distance for the successive five-foot contours These can be taken at right angles to the line run in the same way as a regular preliminary or they can be taken with the points of a compass, north, east, south and west.

In platting these notes the line is drawn for the assumed meridian, and all angles are platted from that line. The line is platted from hub to hub, and all intermediate and side readings are afterward filled in from each hub point. The elevation of all points is marked on the plat and contours, and then platted from the rodman's notes by the use of a table, or preferably with the slide rule. As the horizontal distance from the point of the nearest contour is the total distance between contours, dividing by 5 and multiplying by the vertical distance from the point to the contour sought, the result can be read directly from the slide rule by using 5 as one index.

In running each survey a party of two can run from four to eight miles of survey per day in a prairie country. A third man can put in his time to good advantage examining the adjacent territory, sketching water courses and investigating the drainage.

Two men can check the notes and make the profile in the evening. One draughtsman will require about as much time for platting as a party for taking the notes, as it is a little more work than platting ordinary preliminary where topography is taken. A stadia line including maps and profiles will cost from 40 per cent. to 50 per cent. as much as ordinary preliminary. I do not think the stadia could be used economically in a great many cases, especially in connection with the two-instrument survey.

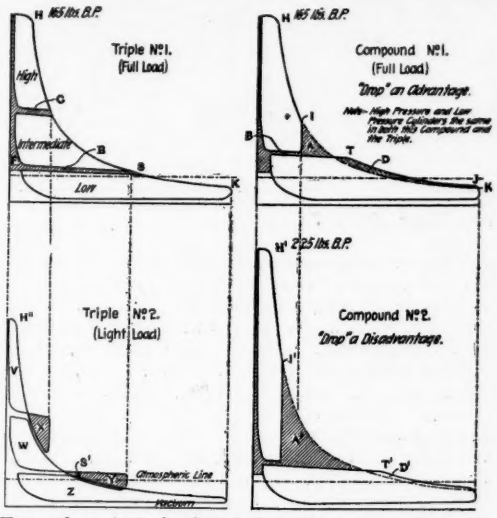
* By John H. Lary. Abstract of a paper in the Journal of the Western Society of Engineers.

Compound vs. Multi-Cylinder Engines.

Those who attended the April Junior meeting of the American Society of Mechanical Engineers learned with some surprise from Mr. Geo. I. Rockwood that he has modified his opinions on the question of compound vs. multi-cylinder steam engines, and now believes that when very high steam pressures are available the triple expansion engine is

theoreti ily more economical than the compound. This ch ge of views has some importance to engineers which will be appreciated when the history of the discussion of the question is recalled. A few facts may well be given, inasmuch as this subject has repeatedly come before engineers during the past nine years, each time only to cover the same ground without getting any nearer to the truth than when the matter was first taken up.

It began in this way: Mr. Rockwood made a series of tests in 1891 of a triple expansion engine, so built that the intermediate cylinder could be "cut out" and the high and the low pressure cylinders run as a two-cylinder compound, using the same conditions of steam pressure and load as in the other case.



From these tests he found that the compound would run on approximately the same amount of steam per hour per horse power as would the triple, and felt warranted in advancing the theory that more than two cylinders in a multi-cylinder engine were unnecessary in order to obtain the highest theoretical economy in the use of steam.

This bold proposition was severely criticised and declared to be inconsistent with established thermodynamic principles; besides, the fairness of the conclusions was called in question. Probably the most serious criticism that could be offered to his work is that he compared triple expansion engines in which the expansion was not carried to the end of the stroke with compound engines having a considerable terminal drop in the high pressure cylinder. The discussion brought out, among other things, the importance of so proportioning the temperature ranges in the high and low pressure cylinders that equal condensation should take place in the two. Such confidence had Mr. Rockwood in the results that his engines for very heavy work have since then been designed compound, when other engineers might have insisted on triple or possibly quadruple expansion. But Mr. Rockwood's cast-iron rule has at last been broken, just why we do not know, but possibly it is because he has come to see the limitations of his former conclusions; this, however, is only a guess. The strange thing is that one series of tests from which questionable comparisons were made should have been regarded as sufficiently trustworthy and conclusive to warant such a sweeping conclusion.

In justice to Mr. Rockwood, the matter should not be allowed to rest with the above statement, for it now appears that a wrong impression was left with those who listened to his remarks at the meeting. While he really confessed to an unqualified change of front, he intended simply to call attention to certain limitations to his theory. The following explanation from Mr. Rockwood will be read with interest:

"More specifically, I was admitting the limits of my theory; that is, that it was a theory with limitations, although satisfactory so far as practical possibilities went at the time I first held it. More specifically still, my theory was correct, and is correct, until a boiler-pressure is reached at which it is better to employ another cylinder. At the time of my first tests (1891), a boiler pressure of 160 lbs. was a great rarity in mill engine work, and I had only once seen a higher pressure carried constantly. Hence, I felt that, as most triple engines were built for 150 lbs. pressure, and as my conviction was that at that pressure there was theoretically no gain—or loss either—arising from an intermediate cylinder, my theory was, for all practical purposes, complete. The loss from 'drop' was, under those conditions, mythical—non-existent. I went too far, however, in one direction. I claimed that with any boiler pressure that could possibly be used in the future, two cylinders were enough.

"I was right in part of this contention; namely, that the loss due to cylinder condensation was reduced to as low a point with two as with twenty cylinders in series. What I neglected was the seriousness of the loss from 'gap' occasioned by allowing too much 'drop'—that is, by having so small a high pressure cylinder as to reduce the number of expansions in that cylinder to too few. A new general condition in boiler practice is nowadays to be seen. All important steam plants carry 130 lbs. to 200 lbs. boiler pressure, and the very high pressures above alluded to are freely talked about on every hand as likely soon to become common in our power stations; so that I had this general condition in mind when I confessed to a partial change of front."

Thus Mr. Rockwood's position is far from that of endorsing the triple expansion engine "as she is designed." What he does advocate is a triple expansion engine working with considerable drop in each cylinder and with what at present must be considered an abnormally high boiler pressure.

By aid of the accompanying diagrams prepared by Mr. Rockwood, it will be possible to make a somewhat critical study of the problem, and to show under what conditions a drop may prove a disadvantage, on the other hand, when it may result in a net economy. The two diagrams on the right are for intermediate compound engines. By "intermediate compound," as here used, is meant a high ratio compound engine, the cylinder ratio in those designed by Mr. Rockwood being about 7:1.

In the triple diagram, No. 1, the "gap" is called C. This area is not lost in the intermediate compound because there is no second cylinder. Moreover, the "gap" F is but about two-thirds as large as in the intermediate compound, inasmuch as the clearance volume of the high pressure cylinder is but two-thirds that of the intermediate cylinder. Besides these savings, the toe of the intermediate diagram is saved by the use of the intermediate cylinder; its position on the compound diagram No. 1 being at A; and it is this area which represents what is known as the thermodynamic loss by free expansion. That part of the whole "gap" represented by B is common to both types of engines. The real question at issue in deciding the relative steam economy of the two types is not whether there is a greater loss of work in the intermediate compound than there is in the triple by reason of the effect of cylinder condensation; but the question to be decided is, whether or not the loss by "drop" results in a net loss of energy. To put the problem in a little different light, the question is, Under what circumstances does the thermodynamic loss A become a net loss of energy, taking into account the whole cycle of operation?

Mr. Rockwood notes in discusing the problem that the term "thermodynamic loss" is a good one to apply to the area A, because thermodynamics, as an exact science, takes no account of cylinder condensation. Its laws of expansion of gases are all based on the theoretical hypothesis that the gas does not change its state in part or in whole by reason of the transference of heat and its recovery at the walls of the containing vessel. Were this hypothesis true of steam while expanding in cast iron cylinders, then the area A would represent an absolute loss of power not to be subsequently recovered.

Returning to the solution of the question under discussion, it may be said in the first place that the terminal pressure J of the expansion in the compound is always somewhat higher than it is at K in the same engine when the intermediate cylinder is used. This but for cylinder condensation could not happen. It does not follow from this that a greater weight of steam is really discharged each stroke of the compound than is discharged from the triple, and this is due mainly to the larger proportion of the whole steam discharged in the compound, as indicated by the terminal pressure. In other words, there is less re-evaporation when the exhaust port is opened, because the steam in the compound is drier than in the triple. This increase in pressure at J is the cause for a recovery of work in the shaded portion D, which is due directly to a reduction of loss by cylinder condensation.

If the discussion has been followed carefully, we will note certain losses and certain gains of the intermediate compound over the triple. To sum up the whole matter in the language of Mr. Rockwood, we are led to the following conclusion: When the "gap" in the compound) due to "drop" (as from I', diagram No. 2 compound)—that is, A'—exceeds the "gap" due to greater cylinder condensation (in the triple expansion engine, from S to K), and to greater clearance (F), and to the wire drawing action of the ports of the intermediate cylinders (C), then does "drop" A', become a net loss.

Furthermore, it may be noted that the intermediate compound engine is superior to the triple compound engine working normally without "drop," because when the cut-off works backward on all cylinders, the low pressure cylinder may get all the work to do. That is (referring to diagram No. 2 triple) X and Y may equal V and W. Then does Z alone represent the useful work done by the whole engine.

This, we believe, sets forth the main points which will come up for discussion at the Cincinnati meeting of the American Society of Mechanical Engineers next week. Many are the questions which may be suggested from the above, but we cannot attempt to discuss them now.

New Passenger Station at Pittsburgh.

The preparations for the construction of a new union passenger station at Pittsburgh, Pa., which have been under consideration for several years, have now been so far completed that work has been begun on the clearing of some of the ground which will be occupied by the enlarged station. The general plan for the building, which was adopted in 1898, has been materially modified. That shown in the illustration printed in the Railroad Gazette of Dec. 9, 1898, made from the architect's drawing, has been abandoned and an 11-story building will be put up. A perspective of the building, as shown in the accepted plan, is printed herewith

New Pennsylvania Passenger Station at Pittsburgh.

This station will stand on the site of the present Union station. The roads using it are the different lines of the Pennsylvania System entering Pittsburgh, viz.: the Pennsylvania Railroad, the Allegheny Valley, the Pittsburgh, Ft. Wayne & Chicago and the Pittsburgh, Cincinnati, Chicago & St. Louis.

The building will be of brick and terra-cotta inside, and the ground floor is to be occupied by the Adams Express Company, the baggage room, the U. S. mail room and the kitchen for the restaurant. There will be a depressed wagon way from Grant Street into this ower floor, for baggage and express wagons, and there will also be an opening on the left from Liberty Street.

The train floor will comprise the waiting room, dining room and restaurant, and the usual toilet and smoking rooms. It will have a high ceiling and handsome decorations. The approaches to the waiting room will be by an inclined drive for cabs from new Grant Street to the level of the train floor, which will be about 14 ft. above the present floor; and the tracks in the train shed will be elevated to the same level.

Above the waiting room will be ten stories for offices, to be occupied by the Superintendent of the Pittsburgh division and the Division Freight Agents of the main line; the Allegheny Valley Railway gen-

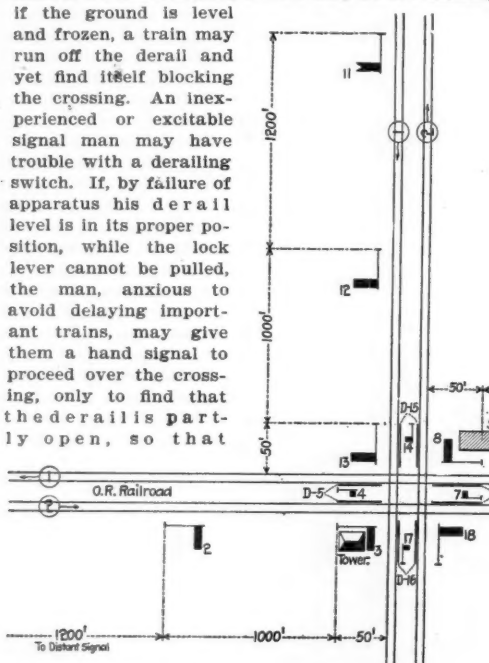
eral office, including the Superintendent's and the Auditor's Departments; and the general offices of the Pennsylvania Company's Lines West of Pittsburgh, including the Erie & Pittsburgh, the Fort Wayne and the Pan Handle. The size of the new main building is 175 ft. x 352 ft.

The most important part of the improvement, aside from the station and train shed, is the elevation of the tracks of the Fort Wayne road. A somewhat imperfect representation of these tracks as they approach the station has been introduced by the architect in the lower left-hand corner of his drawing. These tracks are now on the surface and all trains have to run through and across Liberty Street at grade. The new structure will be elevated so as to give not less than 14 ft. clear headway for street cars and other street traffic, and the elevation will be continued to and across the Allegheny River. This will abolish the two or three grade crossings between the station and the river.

Interlocking Protection for Grade Crossings.*

As grade crossings are usually signalled, there is a derailing switch 300 ft. from the crossing, for movements in the normal direction, with a home signal 350 ft. and a distant signal 1,550 ft. away. For reverse movements the derail is 150 ft. from the crossing and the dwarf signal 160 ft. Circumstances often make it necessary to put the home signal for the normal direction 300 ft. or 400 ft. from the crossing. At right-angled crossings of two different roads, where there is a station at the crossing, the transfer of passengers and baggage is often very inconvenient on account of the long distance from one train to another, this distance between stopping-places being enforced by signals placed as just noted. Whether a train stops short of the crossing or runs completely over it, the respective baggage cars are likely to be several hundred feet apart. To connect conveniently, the easiest way, in many cases, is for one train to make its stop and then go away; and then, after the second train has departed, come back and make another stop, to get the passengers and baggage left by the second train.

In proposing an improvement on this arrangement Mr. Vernon also calls attention to the fact that in some kinds of emergencies a derailing switch is an unnecessary additional danger. To clear a signal on the transverse line, the derail must be open; then, if there is an embankment, a train may be overturned; if the ground is level and frozen, a train may run off the derail and yet find itself blocking the crossing. An inexperienced or excitable signal man may have trouble with a derailing switch. If, by failure of apparatus his derail level is in its proper position, while the lock lever cannot be pulled, the man, anxious to avoid delaying important trains, may give them a hand signal to proceed over the crossing, only to find that the derail is partly open, so that it ditches the train. To fully protest the transverse track a derail should be 800 ft. away, but this again is objectionable, as it leaves an opportunity for a train to stand between the switch and the crossing, thus leaving the transverse road without suitable protection.



Mr. Vernon's Plan for Crossing Signals.

Mr. Vernon proposes to substitute detector bars for derailing switches; and to strengthen the safeguards he would have a rear home signal, as shown in the diagram.

This crossing is protected by detector bars and signals, instead of by derailing switches and signals. Detector bars, each 45 ft. long, are located as near as possible to the crossing. The left-hand movement is governed by a dwarf signal which is located 50 ft. from the crossing. When changing the right to the crossing from one road to the other, the detector bar levers must be reversed before any signals can be given to cross from either direction, either right-hand movement or left-hand movement.

The right-hand movement is governed by a second home signal located 50 ft. from the crossing, a first home signal 1,050 ft. and a distant signal 2,250 ft. from the crossing. The combination is so arranged that one signal, either No. 3, 2, 4, 7, 8 or 9 locks signal No. 12, 13, 14, 17, 18 and 19; and one signal, either No. 12, 13, 14, 17, 18 or 19, locks signals No. 3, 2, 4, 7, 8 and 9. Distant signals lock their home signals in their clear positions, as in common practice.

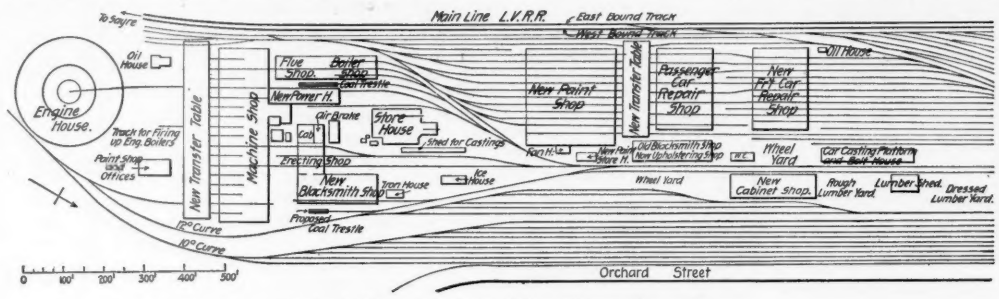
A train approaching the crossing on track No. 2 of the O. R. RR. will have all three signals clear to cross over, where it may stop with its rear end 50 ft. clear of the crossing, which is just far enough to clear dwarf signal No. 7. Until the train has reached this point, no signals can be given for a train to approach on the other road. When the first train has cleared dwarf signal No. 7, however, the detector bars may be reversed and signals given for a train to advance to the station from either direction on the Q. P. RR. Therefore it is both safe and convenient for both trains to stand at the station and transfer passengers and baggage, and at the same time either train or both trains may depart when ready to do so.

Now follow the movements of two trains approaching the crossing, the first on track No. 1 of the O. R. and the second train on either track No. 1 or No. 2 of the Q. P. The first train having only one signal, No. 9, clear for him, advances to signal No. 8, which wil be at danger and should bring the train to a full stop. Then the towerman must put back his detector bar levers Nos. 5 and 6 before he can pull detector bar levers Nos. 15 and 16 for the freedom of any signals to approach the crossing on the Q. P.

Consider now the case of an express passenger or freight train approaching the crossing from either direction on the O. R. The engineer being accustomed to having clear signals at this point and not finding the distant signal clear, attributes it to neglect on the part of the towerman, and fails to obey the signals. The train proceeds at a fair rate of speed to the first home signal, which is also against it. The engineer then applies his brakes and he has a distance of 1,000 ft. in which to stop before reaching the second home signal. In this case he will not derail his train nor do any damage to persons or property by running past the first home signal.

A new towerman is not so dangerous at this crossing in case he has trouble in getting his combination or clearing his signals. Knowing that no trains are approaching on the intersecting road, he takes the liberty of giving a hand signal to pass the first home signal, and the engineer, seeing the second home signal at danger, will proceed cautiously until within speaking distance of the towerman, when he may be told what the trouble is and that he may proceed. While the arrangement, shown in the drawing, is more convenient for train movements, and in my opinion safer than the ordinary way, with one home signal at danger. I believe that derailing switches are the proper protection for main lines approaching drawbridges and for side-tracks leading to main lines.

*A paper by J. I. Vernon, Supervisor of Interlockings, Eastern District, New York, New Haven & Hartford, read before the Railway Signaling Club at Chicago May 8. Condensed.



General Plan of Lehigh Valley Shops—Sayre, Pa.

These improvements are now completed, and have resulted in closing the passenger car shops at South Easton, Hazleton, Delano, Ithaca and Cortland, while all heavy box-car repairs have been discontinued at all points except Sayre, and locomotives on the Buffalo Division needing heavy repairs are being sent to Sayre for attention as the necessity arises.

The building marked "machine shop" on the plan has been extended 147 ft. to give six more pits in the erecting side of the shop with a corresponding increase on the machine side, and the erecting side now has a capacity of 17 engines. An electric transfer table has been put in for shifting engines in and out of the shop, which table is wide enough to handle an engine and tender coupled together. The transfer table is fitted with a 50 H.P. motor, which motor not only moves the table, but is used for pulling locomotives on or off the table. There are three drop tables on the erecting side of the shop which are used for removing or replacing driving wheels under the locomotives. The machine side of the shop has been strengthened by the addition of one large modern driving-wheel lathe 90-in. swing, one Warner & Swayzee screw machine, one flat turret lathe, one engine lathe 36-in. swing, one planer, 42 in. x 42 in., and one Bullard boring mill 51-in. swing.

The building marked "flue shop, boiler shop" was formerly two separate buildings. These have been joined, and in the end marked "flue shop" the locomotive flues used on this road are handled. The flue shop is fitted with two welding machines, together with the necessary apparatus for swedging the flues, cutting them to length and testing them. One peculiarity of the flue-work here is the method of cleaning the flues when first removed from boilers. This is done by putting the flues in a large furnace where they are heated to a cherry red; they are then dipped into cold water, and the sudden contraction knocks off the scale. By experience this is found to be the best and cheapest way to clean flues. No change has been made in the boiler shop end of this building, as none was necessary.

The new power house contains all of the boilers that furnish steam for the plant, also all of the electrical generating apparatus needed for lighting the shops and yard, operating transfer tables and running motors. The power house is divided into three compartments, namely, the engine-room, the pump-room, and the boiler-room. The engine-room contains one stationary horizontal engine, which is used for driving and shafting in the machine shop, two arc light dynamos, capacity of each 75 lights, one 50 kw. power dynamo, two 25 kw. incandescent dynamos, and one 10 kw. incandescent dynamo. A switch-board is aranged so that during the day when the incandescent lights are not required, one or both of the 25 kw. machines can be switched over to the power circuit. The dynamos are all driven by Harrisburg high-speed engines; all of the dynamos, except the arc light machines, being direct connected.

The pump-room contains the necessary boiler-feed apparatus and feed-water heater, also one Ingersoll-Sargent independent air compressor with a capacity of 600 cu. ft. of free air per minute, and the engine for running the fan in connection with forced draught under the boilers. The boiler-room is fitted with Babcock & Wilcox water-tube boilers, with a total capacity of 1,250 H.P. These boilers have forced draught with low stack, and there is space left in the boiler-room for an addition of 250 H.P., if that is found necessary later on. Along one side of the boiler-room a trestle has been built, on which coal cars are placed to be unloaded.

The new blacksmith shop is 75 ft. x 200 ft., and contains 32 fires. This shop is fitted with the Buffalo Forge Company's system of underground blast and exhaust, and the shop is a modern one in every respect.

The building marked "erecting shop," which adjoins the new blacksmith shop, has been fitted up with axle lathes, steel-tired wheel lathes, boring mills and wheel-press. In this shop the steel-tired wheel work for the entire road is handled, also the cast-iron wheel work for the Sayre shop. No change was made so far as the storehouse is concerned.

The new paint shop is a brick building, with roof of the saw-tooth pattern, and the light entering the shop through the sky-lights in the roof is all from

The Lehigh Valley Shops at Sayre.

We gave recently (April 13, page 230) a short account of the remodeled shops of the Lehigh Valley Railroad at Sayre, Pa. We give now a more complete description and a general plan. The increasing of shop facilities at Sayre was decided upon to concentrate at that point all passenger car-work and all heavy box-car repairs, and to be able to take care of locomotives needing heavy repairs from the Buffalo Division.

the north. This building contains 12 tracks, with a capacity of 36 passenger equipment cars at one time. The building is heated and ventilated with hot air, on the Buffalo Forge Company's system, and is well supplied with arc and incandescent lights, there being 83 of the former and 144 of the latter. The incandescent lights are supported by adjustable fixtures that can be moved in any direction. On the east side of the new paint shop a paint storehouse has been built. This is practically fire-proof. Passenger equipment cars are taken into the paint shop by means of the transfer table, or they can be brought in from the other end if necessary, and can be taken out in the same way. The transfer table between the paint shop and passenger repair shop is driven by elctricity, and is fitted with a 25 H.P. motor. The motor not only runs the table, but also is used for pulling cars in or out of either shop.

The passenger car repair shop was formerly used for freight car repairs. It has a capacity for 14 passenger cars at one time. This building is well lighted, and is liberally supplied with arc and incandescent lights.

The building marked "old blacksmith shop" has been divided into three compartments. One compartment is used as an upholstering shop, one compartment is used as a brass-cleaning-room, the third compartment is used as a tin shop. The new cabinet shop is a brick building 60 ft. x 200 ft. This shop contains all of the wood-working machinery that is needed at Sayre in connection with passenger and freight-car-work, which machinery is driven by an electric motor. There is a small motor in the upholstering shop which is used for running the shafting located in that building. The new freight car repair shop is a brick building in which freight cars are placed that need heavy repairs, and this shop has a capacity for 33 cars at one time. The tracks north of the freight car shop are used for freight cars needing light repairs.

All of the shop buildings are liberally supplied with arc and incandescent lights, steam heat, and plenty of compressed air.

It should be borne in mind that the improvements made at Sayre were mapped out so as to make the best use possible of the buildings existing at that point, before the improvements were stated. If the plant had been laid out new throughout certain features might, with justice, be criticised; but when we take into consideration the fact that plans had to be made to a large extent to conform to the original plant, there are good reasons why the arrangement as shown on blue print was adopted. For instance, the head of the department would like to have electric over-head cranes on the erecting side of the machine shop. To install such cranes it would have been necessary to practically rebuild this shop. From the experience of other roads he was not able to figure out a proper return on the increased cost of the electric over-head cranes, and therefore, decided on the installation of the transfer table.

There is sufficient space left between the new freight car repair shop and the passenger car repair shop for the installation of an electric transfer table, and if it is found that shifting cars on and off the repair tracks in front of the freight car shop is not working to advantage, a transfer table can then be installed between the two shops, so that the cars can come in from one end and after they have been repaired they can be run through the shop and taken out by means of the transfer table.

We are indebted to Mr. Higgins, Superintendent of Motive Power, for the information and drawing now published.

Fast Runs on the Burlington.

The Chicago, Burlington & Quincy recently made two fast runs, with four-car trains, between Burlington, Ia. and Chicago, which were briefly noted at the time. The official figures, however, are now at hand, and are given in the table below. On both occasions train No. 8 was late at Burlington, and the run to Chicago was made by Engineer Gillette, with engine No. 1510, a mogul locomotive of the H-2 class, having 69-in. driving-wheels and cylinders, 19 x 24 in. The time deducted for stops is actual, not estimated. For this information we are indebted to Mr. F. A. Delano, the Superintendent of Motive Power of the road.

Run made April 23, 1900, from Burlington to Chicago. Leaving Burlington 60 minutes late, arrived Chicago 22 minutes late.

Stations.	Miles.	Minutes.	Stops.	Speed miles per hour bet. stations.	Remarks.
Burlington to Galesburg....	43.3	47	1	55.3	4 Minutes lost at Galesburg.
Galesburg to Mendota	79.7	74	2	64.6	5 Minutes lost at Mendota.
Mendota to Aurora	45.4	40	..	69.8	
Aurora to Chicago.	37.4	40	2	56	
	205.8	200	5	.....	9 minutes dead time.

Total time made up 38 minutes on schedule, arriving at destination 22 minutes late. 205.8 miles in 209 minutes, including stops and dead time; 59.1 miles per hour. 205.8 miles in 200 minutes, omitting dead time; 61.7 miles per hour.

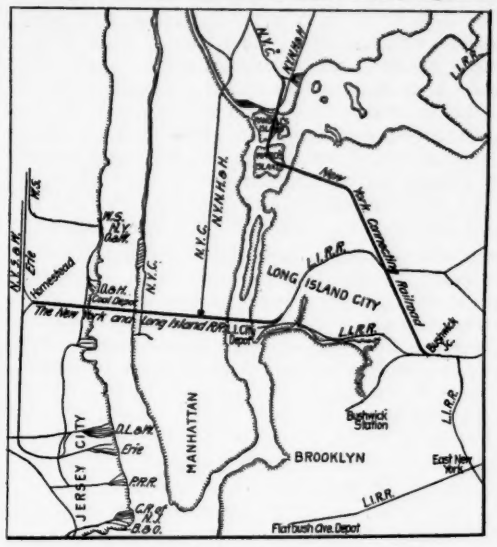
Run made April 30, 1900, from Burlington to Chicago, leaving Burlington 46 minutes late, arrived Chicago 4 minutes late.

Stations.	Miles.	Minutes.	Stops.	Speed miles per hour bet. stations.	Remarks.
Burlington to Galesburg....	43.3	45	1	57.7	1 Minute lost at Monmouth.
Galesburg to Mendota	79.7	71½	1	66.9	3½ Minutes lost at Galesburg.
Mendota to Aurora	45.4	37	2	73 6	10 Minutes lost at Mendota.
Aurora to Chicago.....	37.4	35	2	64.1	
	205.8	188½	6	.....	14½ minutes dead time.

Total time made up, 42 minutes on schedule, arriving at destination 4 minutes late. 205.8 miles in 203 minutes, including stops and dead time; 60.8 miles per hour. 205.8 miles in 188½ minutes, omitting dead time; 65.5 miles per hour.

Certain "Connecting" Railroads in New York City.

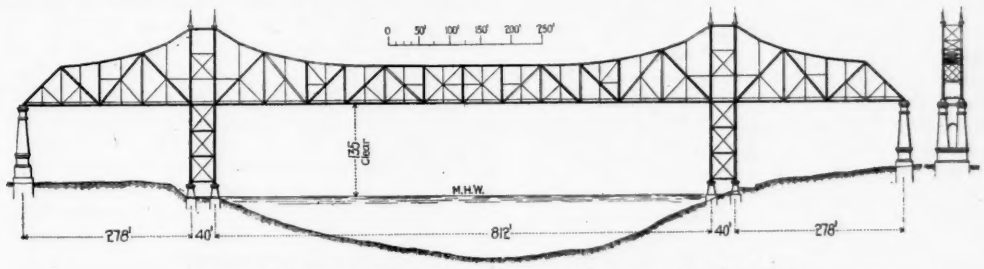
Governor Roosevelt has signed the bill which authorizes the New York Connecting Railroad Company to build its bridge across the East River, together



Two Connecting Railroads in New York City.

with viaduct approaches. The New York Connecting Railroad Company was incorporated April 21, 1892, and proposes to build a double-track railroad, connecting the New York Central & Hudson River with the Long Island Railroad. The line begins in the Borough of the Bronx, at St. Mary's Park, on the Port Morris Branch of the New York & Harlem. It runs south across Bronx Kill, Randall's Island and Little Hell Gate to Ward's Island; thence east across the main channel of the East River to Astoria, and thence southeast in Long Island City, through Charlotteville, Woodside and Maspeth to Bushwick Junction, where it connects with the main line of the Long Island Railroad. The entire length is about seven miles, of which one-half is made up of the bridge across East River and the approaches. These approaches are to be steel viaducts, each about 1½ miles long, on specifications similar to those of the New York Central improvements on Fourth Avenue.

The bridge, according to the bill, is to be 135 ft. above mean high water. It is to be cantilever in construction, and of three spans. The longest, 812 ft., is to span the main channel of the river. The two end spans will be 278 ft. each. The entire length of the bridge, including spans and towers, is 1,448 ft. The width between the trusses will be 30 ft. Building must be begun by Sept. 1, next, and the bridge completed within five years from that date. Negotiations are pending for the rights of way. Immediately after this is completed, contracts will be let for the grading, track-laying, etc. The officers of the company are at 55 Broadway, New York. Oliver W. Barnes, Civil Engineer, who has been the President of the company since its organization, April 21, 1892, resigned April 20, 1900, to take the contract for the construction of the line. He will have charge of the engineering, procure the rights of way and real estate and superintend the building and equipment for a construction company, which will be formed for the purpose of financing the enterprise. The present officers of the railroad company are: President and Chief Engineer, Alfred P. Boller; Secretary, F. M. Clute; Treasurer, W. A. Barnes; Counsel, John McDonald. The estimated cost of the whole road, including the viaducts, bridges and surface road, is $5,500,000.



Proposed New York Connecting Railroad Bridge Over the East River.

While the newspapers of New York City are building on paper all sorts of connecting lines between the Pennsylvania and the Long Island railroads, they have overlooked the New York & Long Island road, which was chartered in New York, July 30, 1887. Later, a charter was obtained for the New Jersey Division in New Jersey. The proposed route is for a double-track tunnel road across New York, through Forty-second St. West it will pass under the Hudson River and the Palisades, coming out on the Hackensack Meadows, near Homestead, and east under the East River to Long Island, passing under Fifth St., then under Fourth St., and coming to the surface near Dutch Kills, there making connection with the Long Island Railroad. At the western end short links will connect the tunnel road with the Central of New Jersey, the Pennsylvania, the Delaware, Lackawanna & Western, the Erie, the New York, Ontario & Western and the West Shore. On the west side of Manhattan Island a branch would come to the surface to connect with the West Side line of the New York Central, and with the docks and yards of that company. Provision would also probably be made to bring a branch to the surface near the Grand Central Station. In addition to the charter rights, the company has secured right of way and consent of the property owners, and everything is ready to move forward as soon as the project can be financed. Work was begun about four years ago in sinking a shaft 100 ft. deep on Long Island. At that time the principal stock owner was the late William Steinway, who was also Chairman of the Board, but his death put an end for the time to the work, and nothing has been done since that time. It is estimated that the completed road would cost about $8,600,000.

Foreign Railroad Notes.

The sufferings of brakemen in winter, climbing upon and running over the tops of freight cars, with the mercury frozen and the wind blowing a gale, are only too well known on our northern lines, but we doubt if we can match a recent German story. A brakeman had just put out the tail lights, when the train started and he was only able to jump to the side step of a freight car, where he had to ride clinging to an iron grip, to the next station. There he was found with his hands and arms frozen stiff and white, so that only with difficulty could his hands be made to loose their grips.

The oldest railroad in Russia, connecting the Czar's summer palace with St. Petersburg, has until this year maintained its independence, having little connection with any other railroad, and necessarily so, because it is of 6-ft. gage, while the Russian standard is 5 ft. This line, 17 miles long, was opened in 1837, and had as its engineer the Austrian F. A. von Gerstner, who almost immediately after completing it came to this country, examined all our railroads, and published a quite full description of them in two quarto volumes, which remains the best account of American railroads at the time, though so far as we know not a single copy of it exists in this country. This Zarkoje-Selo Railroad, as it is called, has been bought by one of the newer Russian companies, which will change it to the standard and make it part of its considerable system.

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EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to improvements. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

Mr. Powell, President of the Order of Railway Telegraphers, has formally discontinued the strike of operators on the Southern Railway, "Effective at 11 a. m., May 8." What would happen if some member should make a mistake and stay "out" until 11 p. m., is left to the reader's imagination. General Manager Gannon has issued, on behalf of the road, two pamphlets, in which is set forth the correspondence between the company and the leaders of the brotherhood for several months preceding the strike. These letters and telegrams only confirm the opinion, which everybody must have formed on reading the press dispatches, that the leadership and management of the strike was wretched. Only eleven per cent. of the operators left their work. The brotherhood circular preliminary to the strike said that members not voting would be counted as voting in favor of a strike! The managers of the road appear to have kept a conciliatory spirit throughout. While no outsider can presume to judge of the precise merits of the case, and while no one would claim, on the basis of these pamphlets, that the officers of the road were always wise beyond human wisdom, it is clear that the so-called strike was not only ill-judged, but almost childish. Few, if any, definite claims were formulated for more pay or less work. Mr. Gannon repeatedly suggested that the conductors' and enginemen's brotherhoods found no difficulty in presenting grievances through the official channels which the management desired the operators to use; but Mr. Powell did not profit by the suggestion. Several members of the order had been dismissed by division superintendents of the road, but the claim of the management that these dismissals were justified by individual neglect or incompetency are not refuted. To the reader of these pamphlets one clear fact is the youthfulness of the majority of the operators. With a membership lacking experience, a brotherhood must be afflicted with leadership wanting wisdom. We should judge that the surest way for the road to improve the steadiness and reliability of its force of operators would be to gradually secure men (or women) who have seen a little more of life.

Railroads have been somewhat slow in using electricity for power and lighting in the shops, although for some time the advantages must have been apparent from the way manufacturing plants have been remodeled to use electricity. But that a change is surely coming is shown by a number of roads making improvements of this kind, while still more are contemplating changes, and plans for new shops invariably include more or less electrical machinery. In the natural course of events, the railroads must become important buyers of electrical generators, motors, cranes, etc., just as now they are large buyers of other kinds of shop machinery. It is in line with these changes that we find electricity versus transmission by shafting as one of the subjects for report at the next meeting of the Master Mechanics' Association. So far prominence has only been given to the improvement of large shops, where the buildings are scattered and there is an opportunity, by using electrical transmission, to consolidate several steam plants into one large central station. There is, however, a larger number of small shops at division points where electrical plants can be used to advantage in conjunction with the present steam engines and boilers. Such an installation was described in our last issue, that at the Ft. Madison shops of the Santa Fe, where the offices, shop buildings, grounds and an extensive switching yard are lighted, and incandescent lamps are used on switches. This is in addition to working transfer and turntables, and possibly, in the future, a large drawbridge, for all of which purposes electric motors are particularly adapted. Particular attention is called to the fact that in this case it really costs no more, counting interest and depreciation, for a larger number of lights and better ones, and for better means for turning and moving locomotives, and there are many shops where a small expenditure will give as good results as at Ft. Madison. Mechanical men who are unable to get the approval of managing officers for extensive improvements in the large shops may find it advantageous to begin with the smaller shops, where, at a small first cost, the advantages of electricity can be quickly shown. Another thing which will promote needed shop improvements is definite information as to the cost of doing work. If railroad shop men had a more definite idea of what it costs to do work under present conditions, the result would be an astonishing amount of shop improvement in which electricity would be an important factor, just as in the case of the commercial shops.

The Pennsylvania on Long Island.

The railroad sensation of the week has been the acquisition by the Pennsylvania of the control of the Long Island. That this has taken place appears to be certain, and naturally folks are speculating as to what it means, and many absurd reasons are given.

We may at once rule out the notion that the Pennsylvania is going to establish a port at Montauk Point. We suppose that now that Mr. Corbin is dead no man of any importance thinks that it would be wise to make a terminal port, or even a port of call, at Montauk Point. That was one of the dreams which Mr. Corbin cherished almost alone.

There are, however, some very excellent reasons for the step which the Pennsylvania has taken, and indeed, we suspect that it is carrying out ideas that Mr. Cassatt has held for a good many years. We know that he long ago considered the possibility of invading Brooklyn by way of Staten Island and a tunnel under the Narrows. We do not know that he has ever abandoned this notion. It may be that as the scheme finally works itself out it will be found better to take advantage of the franchise owned by the Long Island for a tunnel across the East River, connecting that with a tunnel across the North River. For the present, however, and we should suppose for a good while to come, the freight business will be handled by car floats. The Long Island system gives a belt line around the city on which freight stations and yards may be conveniently established, and it is easy to see that the freight business of Brooklyn may be made very valuable to the Pennsylvania without cross river tunnels.

We should doubt if there would be any considerable change in the current of passenger business, certainly not until a tunnel connection with New York City is made. It is quite conceivable that passenger cars will be floated around from the Brooklyn terminals to the Pennsylvania terminal in Jersey City some time; but this arrangement would be rather a matter of comfort to the traveler than a means of building up any considerable travel or of increasing the revenues of the Pennsylvania Railroad.

We have not seen anything like an authoritative suggestion that the Pennsylvania contemplates trying to make through the Long Island Railroad a closer connection with New England. The scheme of a car ferry across the Sound for freight was tried two or three years ago and given up. It is possible that this may be revived, and indeed many incidental changes in the currents of traffic may come about from this purchase of the Long Island by the Pennsylvania; but we guess that the one great reason is to better command the business of Brooklyn.

In 1885 the Railroad Gazette published a little book on "The Terminal Facilities of the Port of New York," by Mr. Gratz Mordecai, of the Transportation Department of the Pennsylvania Railroad. The last sentence in that book has a new meaning in the light of what is taking place now: "There is probably no one thing which would be more likely to give stability to the values of American railroad properties than the striking example which would be set by the adoption of a broad-minded, well-considered plan for the terminal work at New York."

The Growth of Passenger Traffic.

The first statistics of the Interstate Commerce Commission, for the year ending with June, 1889, covering 153,389 miles of road, showed that the freight traffic of the year amounted to 68,727 millions of ton-miles; for the last year reported, 1898, this traffic was 114,078 millions on 184,648 miles of railroad, so that in the nine years the increase was 45,351 millions, or 66 per cent. The population meanwhile increased from 61 to 74 millions, or little more than 21 per cent. To put it in a more comprehensible form, in 1889 a ton of freight was hauled 1,127 miles for every man, woman and child in the republic; in 1898, 1,541 miles. These latter figures are tremendous and significant, and show what a great share transportation has in the industries of the country—enormously greater than in any other considerable country in the world; while with the probable exception of Australia, and possibly of Great Britain, the products of this country also require on the average a greater amount of transportation by sea than those of any other. This is due partly to the very extent of the country, but largely also to its growth under a modern system of transportation at very low rates, which in the larger part of the country almost from the first has permitted any partof the country to obtain a part, and often a very large part, of its bulky as well as its light supplies from other districts one or two thousand miles distant.

The following table shows the course of this freight traffic from year to year, in millions of ton-miles:

Year.		Year.	
1889	68,727	1894	80,335
1890	76,207	1895	85,228
1891	81,074	1896	95,328
1892	88,241	1897	95,139
1893	93,588	1898	114,078

Here we see an increase of 36 per cent. from 1889 to 1893, in which period there was a considerable growth every year. The sudden prostration of business in 1893 is reflected in a decrease in a single year greater than the increase in any two previous years; but the loss was recovered in two years; and the return of prosperity is marked by the great gain of 20 per cent. from 1897 to 1898, while the growth since, as we all know, has been unusually great.

But the statistics of passenger traffic make a very different showing. In 1889 this amounted to 11,554 millions of passenger miles, equal to 189 miles per inhabitant; in 1898 it had grown to 13,380 millions, or 16 per cent., which is at the rate of 181 miles per inhabitant. The total railroad service per inhabitant was, therefore, 8 passenger-miles less and 414 ton-miles more than in 1889. Certainly this difference in the growth of the two kinds of traffic has been extraordinary. The changes in the passenger movement have been from year to year, in millions of passenger-miles:

Year.		Year.	
1889	11,554	1894	14,289
1890	11,848	1895	12,188
1891	12,884	1896	13,049
1892	13,363	1897	12,257
1893	14,229	1898	13,380

Here we see that the passenger traffic as early as 1892 substantially equalled that of 1898; while that of 1893 and 1894 was considerably larger. In both of these latter years (ending with June) the Chicago World's Fair considerably increased travel. But taking what we may call normal years, we find in the three years from 1889 to 1892 an increase of 1,809 millions (16 per cent.); in the three years from 1895 to 1898 an increase of only 1,192 millions (10 per cent.). Thus, not only has the passenger traffic grown much more slowly than the freight traffic, but it has grown more slowly recently than formerly; and compared with the population it has not grown at all.

It should be said, however, that the last year here reported, 1898, was the first of a decided recovery from the bad times following 1893; and that observation of similar periods of returning prosperity shows that travel does not increase notably until prosperity is well established. The better income of the first year or two goes largely toward paying debts, making neglected repairs, etc., and only later for such luxuries as travel. The more recent returns of the railroads show this. Thus the entire Pennsylvania Railroad system had 9½ per cent. more travel in 1899 than in 1898 (calendar years), when its freight traffic increased 20 per cent.; and from 1897

to 1899 on its lines east of Pittsburg and Erie its travel increased 18¾ per cent. (freight, 27 1/3 per cent.).

There is no doubt that a considerable diversion of travel from the railroads has been made by the great increase of street railroads running through country districts. The travel on these lines has been largely a creation, but it has also been partly a diversion. The population of workmen can make cheap and attractive excursions now in many parts of the country by electric railroad lines, and does so by the million. In most such cases a similar excursion over a steam railroad might not be attractive and would rarely be taken; but doubtless many little outings in a street car now take the place of one considerable excursion by steam railroad. In Massachusetts, from 1889 to 1899, the number of street car journeys increased 124 per cent. against an increase of 24 per cent. in the passenger traffic of the other railroads, and the increase in street railroad earnings was $9,392,000, against an increase of $6,525,000 in the passenger earnings of other railroads. In New York in the same time street railroad earnings increased $13,700,000 or 70 per cent.; the passenger earnings of other railroads, $11,520,000, or 26 per cent. While but a small part of the street railroad earnings can come from traffic which the other railroads could carry, yet it was doubtless enough to affect noticeably the rate of growth of their passenger traffic.

This may account for the fact that railroad travel grew less after 1895 than before 1893, but the fact remains that even in the ante-trolley days passenger travel was of comparatively slow growth. In 1879 the Railroad Gazette in an article on the subject showed that from 1870 to 1877 nine leading railroads, including some with a great increase of mileage and in the most rapidly growing parts of the West, had an increase of but 2 per cent. in passenger traffic, while at the same time their freight traffic increased 77 per cent. There was a great increase in the prosperous period beginning with 1879, but the fact that freight earnings increased 60 per cent. from 1877 to 1881, while passenger earnings increased 38 per cent. (with 27 per cent. increase in mileage), shows that in the most prosperous times passenger traffic does not keep pace with freight.

Further, this condition of things seems to be peculiar to this country. It is to be expected that in countries where the number of inhabitants per mile of railroad is several times as great as here, travel should be denser—more of it per mile of road. But we should not expect it to grow faster. The statistics for the whole German empire have just been published for 1898 with some comparisons with 1888. Now in these ten years the freight traffic increased 52 per cent., against 66 per cent. here in nine years; but the amount of freight traffic in Germany in 1898 was only 388 ton-miles per inhabitant, against 1,541 in this country, the increase in Germany since 1888 being 100 ton-miles (35 per cent.), against (since 1889), 414 tons (36 per cent.) here, the increase here being greater than the total in Germany. But the passenger traffic makes a very different showing. In the ten years to 1898 it increased no less than 91 per cent. in Germany; here, in the nine years to 1898, only 16 per cent. In Germany the average travel per inhabitant was 119 miles in 1888; here 189 miles in 1889; in 1898 it was 201 miles, in Germany; against 181 miles here. The average German traveled one-third less than the average American ten years ago; he travels one-ninth more now. And yet Germany is the only important Continental country in which there has been no great and general reduction of fares within this period, such as have been made in Hungary, Austria, France and Russia.

Why is it that travel should grow so much faster in Germany than here? The only obvious answer is that fares are so much lower. The average receipt per passenger-mile in 1898 was 1.062 cents there against 1.973 here. But that does not tell the whole story by any means. First-class fares are higher in Germany than here, but the third-class, and (in more than half of the Empire), a fourth-class give facilities for traveling at extremely low rates such as do not exist here at all. We have been able to develop freight traffic to an extent elsewhere unknown by adapting rates to the greatest variety of circumstances; making the average rate lower than in any other country, and the minimum so little that it permits immensely long hauls of coarse freights. There has been no such elasticity and variety in passenger fares, and in the nature of things there cannot be; but it is by no means certain that more cannot be done to develop this traffic. Certainly the experience of Germany shows that by means of low fares a great development of travel is possible in a country where average incomes are much lower than here, and the growth of population only about half as fast.

Annual Reports.

Michigan Central.—The Michigan Central reports for the year ending Dec. 31, 1899. The gross earnings were $15,504,062; operating expenses and taxes were 77.43 per cent. of the gross earnings, and the net were $4,499,906. After the payment of interest and rentals and a four per cent. dividend and setting aside $65,000 for second track work between Ypsilanti and Dexter there remained a balance of a trifle less than $5,000.

The earnings from freight increased 10.7 per cent., but the ton-miles increased 17 per cent., amounting in the aggregate to 1,951,000,000. The freight rate fell, however, 5½ per cent., namely, from 0.597 to 0.564 cent. So in spite of the considerable increase of business the net results remained almost exactly the same as in 1898.

The passenger-miles increased 14¼ per cent., but the rate fell two per cent. and the earnings from passengers increased but 11.8 per cent. However, it is interesting to observe that passenger-miles and passenger earnings increased so much, considering the important development of trolley competition.

The operating expenses increased 13.8 per cent., and as the average rate received for freight and passengers declined, the ratio of operating expenses to gross earnings shows an unfavorable change; that is, in 1898 working expenses and taxes were 75.08 per cent. of gross earnings, and in 1899, 77.43. The greatest increase in operating expenses was in repairs of freight cars, where the increase was over half a million dollars. There are a number of items in which it was over $100,000; for instance, in repairs of roadway and in repairs of bridges and culverts. Repairs of locomotives also increased more than $100,000, as did the balance of car mileage. Pretty nearly all of the items of conducting transportation showed increase. The statistics published do not enable one to discover whether or not any improvements have been effected in loading cars or in average weight of freight train, and, indeed, they give little information by which we can guess at the skill and economy with which the property is worked.

In Germany it seems that it is not always safe to cheat the railroads. A case in point is that of a person who had occupied various honorary offices in his native town, had served as justice of the peace and was considered a citizen without reproach. He had a little journey to make, and made it on a round trip ticket. This ticket permits the holder to break his journey once on the return ticket, but not more than once. When such a stop-over is made, it requires that the holder have the ticket stamped at the station where the stop is made, which is evidence that stop-over rights have been exhausted. Now our traveller stopped once on his way back and had his ticket stamped in manner and form provided. But he got off at another station further on, and to avoid buying another ticket, which would have cost him 11 cents, he bought what is called a "platform" ticket, which gives admission to the station platform, but no passage, and is used chiefly by persons seeing friends off or meeting them as they arrive. He would not have been admitted on a passage ticket with a stop-over stamp. Now the station ticket collector was alert, and when the train was signalled to start he noticed that a man who went in on a platform ticket had not returned. So the train was held and an inspection of tickets made. The person who had endeavored to save 11 cents showed a ticket, on which there were traces of an erasure of the date stamped at the other stop-over station; whereupon he was required to buy not only a ticket to destination, but a so-called "fine ticket," costing six marks, or $1.43. And this was the end of the matter? Not a bit of it. The ticket with the date erased was delivered to the prosecuting attorney, with a statement of the facts, and the erring passenger was haled before a criminal court, but not until he had been kept under observation by the police for 19 days, as suspected of running away, from which he was released only on giving bonds for 30,000 marks. The charge was "attempt to cheat" and "falsification of documents," the latter being a crime near akin to forgery. The jury found the prisoner guilty on the first charge, and he was sentenced to two weeks imprisonment. To the counterfeiting charge the jury said not guilty: the prisoner said that the erasure of the date was due to holding the ticket with his wet mittens, and that he did not do it on purpose. It is probable, however, that the jury was not so much impressed by the wet mittens story as by the fact that if they had found him guilty of erasing the date he would have been liable to ten years imprisonment! This may seem a pretty smart punishment for stealing an eleven-cent ride, and so it would be. The punishment in that case would have been for the forgery, and not for the cheating. In view of this, we imagine that most American General Passenger Agents and ticket auditors would be able to point out a large circle of "citizens" (as a reporter would say) who have particularly good reasons for congratulating themselves that they live in a "free country."

The Hungarian Minister of Commerce, who has charge of the State Railroads, in presenting his estimates recently spoke of a common complaint against the State railroads, that while they represented an investment of more than $400,000,000, the result of their working was a yearly deficit. This, he said, was true, and the deficit amounts to some $4,000,000. But the Hungarian railroads must not be judged like other State systems, for the management is compelled to have regard more to the economical condition of the country than to financial results and when the national industries and agriculture need help, their chief resource is to secure lower rates of transportation. Within the year past not less than 95 reduced tariffs had been introduced, the effect of which was to reduce earnings by some $2,300,000. The advantage to the country was much greater than this, however, and the Minister intends to continue this policy. The Minister said that the management is continuously experimenting with the application of electricity to train movement, with the intention to work the whole local raffic, freight as well as passenger, as on street railroads, and separate it entirely from the other traffic. The zone system, he said, had as a whole been completely justified; but it is only the short distance and the very long distance traffic that have grown greatly. Since 1889 the short traffic, extending from one station to the first or second station beyond, has increased 590 per cent.; the 14th zone traffic (the largest distances) 414 per cent.; while the traffic of the intermediate zones has increased but 24 per cent. The short distance earnings have increased 299 per cent., the longest distance earnings 268 per cent., the earnings for intermediate distances only 5 per cent. It is purposed to do something to develop the traffic of these intermediate zones.

NEW PUBLICATIONS.

American Railway Association. Proceedings for five years, 1894-1898. New York: W. F. Allen, Secretary, 24 Park Place. Price, $5.

This is the second volume of the Proceedings of this Association, bringing its history down to the end of 1898. The first volume, covering the period from the first Time convention to the end of 1893, was issued last year and was noticed in the Railroad Gazette of May 12, 1899. The present volume contains 826 pages, and, like its predecessor, it contains practically full reports of all the meetings of the Association, as well as copies of committee reports, and in many cases the data on which such reports are based. As in the former volume, Secretary Allen has made a good index. This volume contains, among other valuable matter, the federal and state laws concerning safety appliances, the block signal rules adopted by the Association in 1894-5, the Proceedings of the Association in connection with the International Railway Congress of 1895, and the code of rules for enginemen, firemen, conductors, baggagemen, brakemen, switchmen and telegraph operators, which was reported by the Committee on General Regulations in October, 1894, but which was never adopted by the Association. The book also contains the investigations of the Association on the subject of the metric system and the rules, with illustrations, for loading long timber on platform cars.

Plain Talks to Ticket Agents. By Fred. B. Sankey, 306 Park Building, Pittsburgh, Pa.

This is a little pocket-book of 30 pages, the character of which is well indicated by its title. Mr. Sankey is a traveling passenger agent for the Pennsylvania Lines West of Pittsburgh and his extensive acquaintance with local ticket agents has led him to write for their benefit some short essays on Courtesy, Ambition, How to handle a passenger, Telling the truth, Studying rate sheets, Creating new business, and other topics. Mr. Sankey's 30 small pages are full of good points. He is careful to touch upon all the points which are material to his purpose, and yet the chapters are brief and the young ticket seller will find it easy to remember the good advice that is given. Mr. Sankey evidently fully understands his business. He offers his book to railroad companies in large lots at $25 a thousand.

TRADE CATALOGUES.

Gear-Cutting Machines.—Messrs. Gould & Eberhardt, of Newark, N. J., send us a pamphlet describing two of the smaller sizes of "new type" gear cutting machines made by that house. They build gear cutting machines in 18 different sizes and styles. The name "Victoria" is given to the most popular size of their "new type" machine, which cuts spur gears up to 33 in. diameter and 9 in. face without further attention than the setting. This is a fine-looking machine externally, being designed with skill as to appearance as well as efficiency. Only one belt is used in driving the entire machine. A smaller

size machine is illustrated in the same catalogue for cutting gears up to 24 in. x 7 in.

"Colorado" is the title of a handsome handbook which has just been issued by the passenger department of the Chicago, Burlington & Quincy, describing the attractions of the state named. The book is new throughout, both in matter and illustrations. The text is by Mr. James W. Steele, a writer of taste and one who puts his facts in attractive shape. The pamphlet is full of new half-tone pictures, all of them pleasing, well selected and really illustrative of the subject.

The Stow Flexible Shaft.—The Stow Manufacturing Co., of Binghamton, N. Y., sends us a new catalogue describing the various applications of flexible shafts. Especial attention is called to a new combination of the Stow shaft with multi-speed electric motors and with stationary multi-speed motors for direct connection. Several new tools are illustrated and we are glad to note the ingenuity with which this company continues to adapt its special appliances to the advance of the arts.

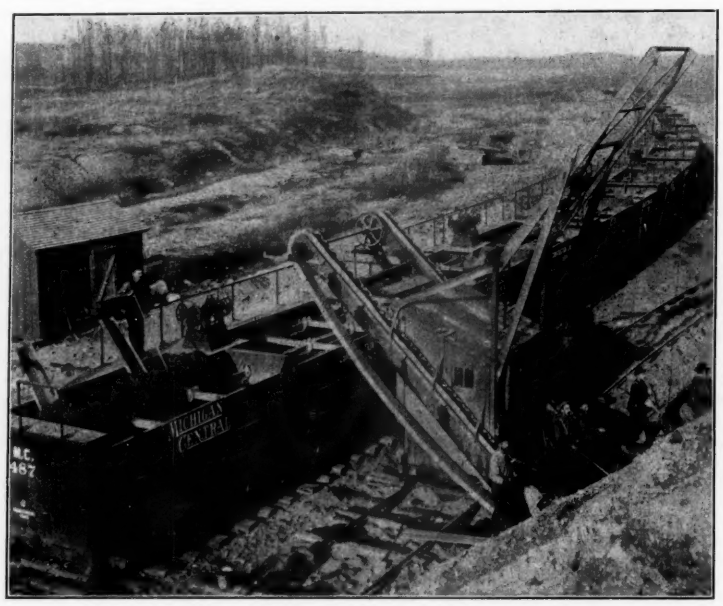
Passenger Car Trucks.—The J. G. Brill Co., Philadelphia, Pa., send a pamphlet, being their No. 27, to describe the "perfect" passenger truck for city, suburban, interurban or steam railroads. The Brill truck is well known to our readers and it is unnecessary for us to say more now than to state the fact that this new pamphlet is available.

The Torrey Ballasting Apparatus.

In our issue of October 13 last, were described and illustrated the apparatus and method of loading and distributing ballast used on the branch lines of the Michigan Central, as devised by Mr. A. Torrey, the Chief Engineer of the road. Since that time the Q & C Company, Chicago, has undertaken to put this apparatus on the market and has issued a pamphlet descriptive of Mr. Torrey's method of ballasting, which also gives the cost of working last season on the Michigan Central.

This method was devised primarily to do away with special work trains where only small amounts of ballast are needed. Work trains are not only expensive in themselves, but they cause delays to regular traffic. By using ballast cars of special design, Mr. Torrey succeeded last summer in doing the work of distributing ballast from the regular way freight trains. The ballast is dumped at the sides and clear of the track, so that it does not interfere with the passage of trains and the section men can complete the work at their convenience.

The ballast cars, which were illustrated in detail October 13, have two sets of doors on each side, an inner and outer set, with special locking and releasing devices for each. These doors are so arranged that sufficient ballast is carried between the inner and outer doors to raise the track about 8 in. for the length of the car, and the same amount is contained above the inner doors. In operation, several cars are put together in a train and dumped by the trainmen between points indicated by stakes or markers at the side of the track, the outer loads being first dumped, and the train then moved ahead the length of the several ballast cars, and the inner loads dumped. The releasing devices can be worked quickly, and the delay to the train is only that of a few seconds, during which the load is falling.



Torrey Ballast Loader and Cars.

The method of loading cars at the gravel pit used by Mr. Torrey, while not a necessarv adjunct of the ballast distributing system, has been found economical. Two tracks are used in addition to storage tracks, one for the cars to be loaded, the other for the loading machine, which can easily be pushed by four or five men. This loading machine is shown by the accompanying engraving and consists of a light car carrying two belt conveyors driven by a gasoline engine, and a framework to which grain scoops are hung by ropes. By hanging the shovels in this way, each man accomplishes the work of three using ordinary hand shovels. The material is shoveled into hoppers and elevated by the conveyors. These are formed of 10-in. rubber belts to which galvanized iron buckets are attached, with overlap at the sides, so no openings are formed as the belt passes around the top and bottom pulleys, which are 20 in. in diameter. The conveyors are so spaced that the first and second sections of a car are first loaded, and inclined troughs are then set up to load the third section. The dump cars or the loading machine may then be moved to load the other three sections of the same car.

The cost of this system of loading, even for small amounts, compares very favorably with that of loading with a steam shovel. The first cost of the machine is about $500, and in working it a foreman and four to six men are employed, the number of laborers depending on the amount of picking necessary. The gasoline engine, which is 2½ h. p., uses 2½ to 3 gallons of gasoline a day, costing 12½ cents a gallon. The amount loaded has been about 200 cu. yd. of gravel a day, this amount having been reached every ten hours when the work of loading could be continuous. The table below shows the cost of loading and delivering gravel on the Michigan Central at the Owosso pit, from August 1 to December 1, 1899, during which time there were 679 cars loaded at a cost of $1,004.95, or $1.48 per car, which, at 22 yards to a car, would be 6— cents per yard. In this amount is included $179.45, the value of the time lost by the pit gang on account of lack of cars at the pit and similar delays.

Cost of Loading Ballast, Michigan Central RR.

Months, 1900.	Cars Loaded.	Days' Work Loading.	Cost of Loading.	Cost of Moving Loading Tracks.	Oil.	Repairs.
August.....	140	23	$212.75	.....	$5.07	$10.00
September...	181	25	246.96	$17.70	6.20	10.00
October.....	175	25.5	229.60	23.10	5.84	7.02
November...	183	23	214.80	.....	5.91	10.00
Total.....	679	95.5	$904.11	$40.80	$23.02	$37.02

The Electric Plant at the Fort Madison Shops.

Last week we described the electric lighting and power plant at the Fort Madison shops of the Atchison, Topeka & Santa Fe. Since writing we have received some further particulars.

In using electric lights in the switch lamps care was taken to keep the shocks, of throwing switches, from reaching the incandescent lamps, as plainly the life of these lamps would be short if attached rigidly to the switch stands. This difficulty was avoided by the method of wiring. The wires for the lighting circuits are carried on poles excepting where tracks are crossed, and at these crossing they are encased in pipe and put underground. Care has been taken to provide sufficient arresters to guard against the overhead wires being damaged by lightning. Also the approach to each switch from the base of the nearest pole is through pipe laid beneath the surface, and at the switch stand this pipe is brought up vertically and bent over so that the end of the pipe is central with the switch stand and extends downward a few inches through the top. The incandescent lamp, of 8 candle-power, is simply suspended from the wires protruding from the end of the pipe, and there being no connection with the switch stand or lamp the operation of the switch does not jar the electric lamps. Lighting switch lamps in this way has made a saving in the maintenance of 28 lamps of about $40 a month.

The total first cost of the plant, including the apparatus for the turntable, was $7,500, and the average cost of operating the electric plant, during seven months, was $35.75 a month. During the seven months, the total charge for wages was $70, the cost of supplies was $46.54, and coal, at 96 cents per ton, cost $133.80. The saving which can be directly attributed to the electric installation is $79 a month, and when the turntable is equipped it will be increased to $119. This sum is made up as follows: Operating switch lights $40 a month; operating transfer table $25, and turntable $40; lighting telegraph office $9, and reduction in the cost of illuminating oil in the main shops $5 a month. In addition to this the shops, offices, shop grounds and switching yards are now well lighted, something that is impracticable either with oil or gas. Possibly the draw span of the Santa Fe bridge across the Mississippi River at Fort Madison will later be equipped with motors and the current furnished from the shop plant. At present, the bridge is turned by a steam engine.

Concrete Arches—I.

By Daniel B. Luten.*

As concrete is considered by many engineers a doubtful material when subjected to the vibrations of railroad traffic, arches of concrete are usually made much more substantial than perhaps is really necessary, and are consequently too expensive to compete with bridges of steel. They have, however, a decided advantage over steel structures in durability, and in strength increasing with age; they require, moreover, no attention for painting or repairs. And they are cheaper than other forms of masonry arches. Lower prices for cement and a better understanding of the nature of concrete is sure to increase the use of this deservedly popular material, not only for piers and foundations, but for superstructures as well.

Experiments made by the writer upon small model arches of neat Portland cement bring out some points that may be of interest in the designing of concrete arches. The experiments were made with especial reference to the vibrations and impacts to which such railroad structures may be subjected; and while the arches tested were of neat cement and not of concrete, the conclusions to which they point are of a general nature not affected by this variation from the actual conditions of practice.

The uncertainty and lack of security of concrete arches may be due to two causes; the doubtful nature of the material, and the indeterminate nature of the forces affecting arch structures. Concrete certainly is not of constant quality, as steel has been proved to be. The coefficient of elasticity of steel varies from 28,000,000 to 32,000,000, a range which is comparatively slight. For concrete the coefficient of elasticity has been found to vary from 1,500,000 to 5,000,000, dependent upon the care in mixing and the proportions of the ingredients. Neat cement has a slightly higher coefficient of elasticity than concrete, and is therefore less elastic.

The crushing strength and tensile strength of concrete can, howeved, be assured within closer limits by the proper selection of ingredients and proper handling. For proper selection, would be required the usual tests for the Portland cement, of fineness, soundness, rapidity of setting, and tensile strength. The writer believes that the tensile test with briquettes is valuable in detecting adulterated cements, and in isolating very weak cements, as in the case of natural compared with Portland, but is of little value in grading competing samples of Portland cement, on account of the irregularities involved in the method of mixing and testing. Proper handling implies that the materials shall be so proportioned that the cement shall as nearly as possible fill the voids in the sand, and the mortar fill the voids in the stone or gravel; that wooden forms shall not be permitted to absorb the water from the concrete before setting has occurred; that the concrete shall not be disturbed during the process of setting; that it shall be properly guarded against frost; that it shall be kept moist for several days after placing; and so on. A quality of concrete can be thus obtained which may be relied upon to sustain 300 lbs. per square inch in compression, 60 lbs. per square inch in tension, and 100 lbs. per square inch in shear, the factor of safety in each case being taken as six.

The uncertainty of the arch form of structure is occasioned mainly by lack of stability of abutments. If the abutments are stable and the span invariable, the concrete arch admits of rigid anaylsis, provided it be made in segmental circular or parabolic form. If other forms are desired, as the elliptical or the five-centered arch, the solution may be made for a parabolic ring that approximates to the given curve, and the design then modified to the desired form by applying additional material purely as an ornamental feature. Such modifications must be made, however, with good judgment, so as not to upset previous assumptions.

The writer has designed an arch in which stability of abutments and invariability of span are secured by the use of timber ties extending from abutment to abutment beneath the water line. The ties are designed to carry the horizontal thrust of the arch, and the abutments are not therefore required to depend for stability upon their weight, or upon the doubtful resistance of earth filling; the pressure of

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the abutments upon the gravel or earth foundation is consequently vertical and uniform; the abutments may be made much lighter than in the usual method of construction; the cost of construction is decreased; and danger of cracking at the crown due to settlement of abutments is diminished. The timber ties help to maintain a secure foundation, preventing scouring of the bed of the stream and undermining of the abutments. Timber is the most suitable material for the ties because of its great durability when immersed in water.

Models of such arches to the number of 30 were tested to determine the comparative effects of loads and impacts on arches with or without ties. The models were of 4-in. span, ⅝-in. rise, 2½ in. length, and ⅜-in. thickness of arch ring. The timber ties, of which there were two, each ¼ in. square in section, were embedded in the abutments, being secured by interlocking cross-timbers, all shown in

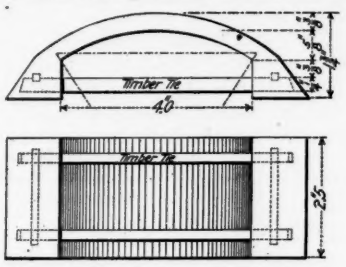

Fig. 1.—New Design of Arch—Luten.

Fig. 1. The arches were of neat Portland cement; after molding they were kept moist for 24 hours and afterward immersed in water for six days. They were then removed and the arch permitted to dry, the timbers, however, being kept continually wet in order to prevent shrinking. They were broken at ages varying from 10 to 20 days, being tested in pairs, one with the timbers cut so as to be useless, the other with the timbers intact.

The first tests, which were for steady load, were described in Engineering News of Feb. 15, 1900. Each pair of arches was bedded upon 1 in. of wet sand, purposely to reduce the horizontal reactions of the abutments. The loads were concentrated at the crown. In four trials the arches without ties broke at an average of 30 lbs., while those with the ties failed at an average of 180 lbs, the failure being due in each case to the pulling out of the timbers. Subsequent models were modified by notching the timber ties before embedding in the cement, the interlocking cross-piece being discarded; this change proved a decided improvement. Three tests were also made in which the loads were distributed over the arch ring by a bed of wet sand carried over the arch, and also tamped as filling against the abutments, care being taken, however, to compel the arch ring to carry all of the load. The arches without ties broke at an average of 40 lbs., the ones with ties at 290 lbs.

Since that time further experiments have been made, the first of which, shown in Fig. 2, were similar to those already described. The two arches were

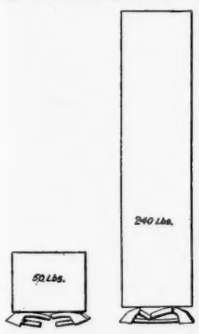

Fig. 2.

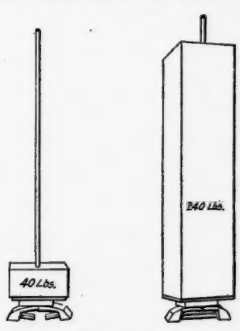

Fig. 3.

placed upon a roughly dressed plank, with no attempt to fit the foundations to a bearing surface and were then subjected to loads applied at the crown, cast iron weights of 10 lbs. each being used. The arch without ties fell at 50 lbs., the one with ties at 240 lbs. An analysis of the latter arch by Greene's graphical method shows that the horizontal thrust amounted to about 270 lbs., the most of which must have been resisted by the timbers, producing a stress of about 2,000 lbs. per square inch. The stress in the cement of the arch ring was computed on the assumption that the forces increase uniformly from the neutral axis, an assumption that perhaps is not justifiable when applied to material at the point of rupture, but which must be accepted for lack of better information. The greatest stress was found at the crown, amounting to about 1,600 lbs. per square inch in compression, with the average compressive stress on the section 800 lbs. per square inch; and in tension a maximum stress of 700 lbs. per square inch, with 350 as the average tensile stress on that section.

The load required to produce these same stresses in a similar but larger arch would be proportional to the square of the ratio of increase; thus, in the case of an arch 100 times as large, in which the span would be 33 ft., rise 5 ft., thickness at crown 3 ft., and length 21 ft., a load of 100 squared, times 240 lbs., equal to 1,200 tons, would, if concentrated at the crown, produce the same stresses in arch ring and ties.

Experiments were also made to determine the action of the arches under loads suddenly applied. The arches, as shown in Fig. 3, supported directly upon a plank foundation, were loaded with cast iron weights lowered upon the arches at the crown by means of a differential pulley. The hoisting apparatus added a weight of about 10 lbs. to the loads applied. A load of 20 lbs. was lowered upon the arch without ties, being applied in about one second of time and removed after an interval of one minute. Ten pounds was then added to the load, and the 30 lbs. applied as before. The arch failed at 40 lbs. On the arch with ties the first load applied was 20 lbs., and subsequent loads were increased 20 lbs. for each application. At the thirteenth loading the arch crushed down under a total of 260 lbs. Three more tests of the same kind gave 40 lbs. as the average load for the arches without ties, and 240 lbs. for the arches with ties.

Experiments were next tried for impact in order to determine the possible effect of accidents, pounding of driver counter weights, etc., upon such structures. The two arches were placed as shown in Fig. 4, upon a plank foundation, in order that there might be but slight yielding of the support, which would otherwise absorb the energy of the blows; wet sand was tamped against the abutments and over the crown to a depth of ½ in.; a section of 1-in. board was so placed as to bear upon the arch ring only. A 10-lb. cast iron weight was suspended by a cord

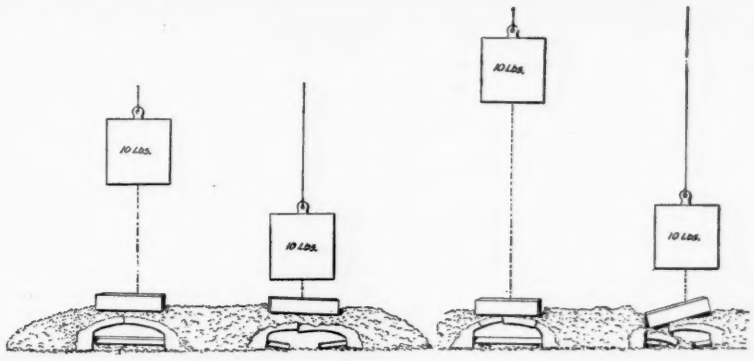

Fig. 4.

Fig. 5.

which when cut permitted the weight to fall upon the board bedded on the sand cushion on the arch ring. After each blow the sand was releveled over each arch to the same depth of ½ in., so that the successive blows were delivered under practically similar conditions. The arch without ties sustained two blows, the first from a height of ¼ in., the second from ½ in., but failed under the third application, the weight falling ¾ in. The condition of the arch after the third blow, together with the height from which the weight was dropped, are shown on the right of Fig. 4. The arch was subjected to a fourth blow from a height of 1 in., which caused complete failure, as represented by the diagram to the right in Fig. 5.

The arch with timber ties was subjected to successive blows from the 10-lb. weight, falling first 1 in., then 2 in., then 3 in., 4 in. and 5 in. At the sixth blow from a height of 6 in. the arch cracked at the crown, as illustrated in the view on the left in Fig. 4. Nevertheless it sustained three more blows from heights of 7 in., 8 in. and 9 in. respectively, without further signs of failure. At the tenth blow, with a drop of 10 in., a second crack appeared, at the haunch. The eleventh blow produced a crack on the other side, shown in Fig. 5, with the weight suspended at 11 in. The twelfth blow crushed the ring down upon the timbers. Three similar tests proved the above results to be fair averages. Examples of the mode of failure of the arches tested for impact are shown in Fig. 6, in which the two on the right

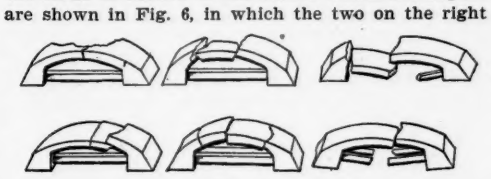

Fig. 6.

were without ties; these two, of course, failed by cross breaking, as the resistance of the abutments to horizontal thrusts could not have been great. The other four were equipped with the timber ties; of these, two failed by crushing of the material, and two by shearing of the ring at the haunches. In none of the tests did the timbers show any signs of weakening.

A test was also made upon a bar of medium steel, selected as a girder to carry a load equivalent to that borne by the arch. By experiment it was found that a bar ½ in. x ⅛ in., laid flatwise upon two supports 4 in. apart, would fail under a steady load concentrated at the middle of the span, of 180 lbs., which was the load borne by the arch when bedded upon a sand foundation. Such a bar of steel was overlaid with a cushion coat of ½ in. of sand, upon which was placed the section of 1-in. board, barely covering the span of the girder. A 10-lb. weight was then dropped upon this improvised steel bridge from a height of 1 in., 2 in., and so on, the sand cushion being replaced each time; at the fourth blow, with a fall of 4 in., the bar yielded slightly, and the fifth blow from 5 in. bent it almost to a right angle.

No quantitative deductions can be made from tests on such small arches of cement, to be applied to larger arches of concrete, but certain conclusions are suggested. That if the resistance of the abutments can be made a definite, determinate quantity, the safety and efficiency of the arch are many times increased. It is of course admitted that in these tests, the arch without ties was subjected to very unfavorable conditions; but as the pressure of the earth backing against the abutments is in any case a doubtful and variable quantity, and one that could not well be reproduced, there was no alternative. If the concrete arch can be built upon solid rock foundations, there is then, of course, no necessity for timber ties. In a majority of cases, however, the foundations are on yielding soil, of a doubtful nature, and the solution has hitherto been supports by means of vertical piling. Since the greater forces acting upon the abutments of an arch structure are in the majority of cases horizontal and not vertical, the tie rods would prove a more rational solution, and the piling could in most cases be omitted.

An equally important conclusion is suggested by the ability of the arch to withstand impacts after incipient failure by cracking at the crown. The arch with ties, of Fig. 5, was cracked by a 10-lb. weight falling 6 in., the energy of the blow being 60 inch-pounds. It then resisted without further failure, successive blows of energy 70, 80, and 90 inch-pounds, and failed under a blow having twice the energy of the one that produced the first fracture. The writer does not maintain that the ability of the arch to support loads is increased by the cracking; but he does maintain that its ability to sustain impacts is not necessarily decreased thereby, provided the stability of the abutments is assured. And this idea seems reasonable from a theoretical standpoint. For the energy of the blow is absorbed by the deflection of the arch multiplied by its resistance. An arch hinged at the crown will deflect more than one not hinged; after cracking, therefore, the increased deflection permits decreased resistance. The compressive stress at the point of cracking would probably be increased, but the tensile stress, the more doubtful quantity under impacts, would be eliminated.

It will doubtless be granted by most engineers that concrete can be safely trusted to bear steady loads; numerous successful highway arch bridges of concrete testify to this conclusion. If, then, an arch be properly designed to support with safety the greatest steady load that would ever come upon it, there would be no doubt as to its safety provided all loads were of this kind. If, however, the arch were to be subjected to the same loads applied suddenly but without impact, then it would be satisfactorily designed if, according to the well-known law of suddenly applied loads, the factor of safety of the material used in the latter were two times that of the material of the former arch. But there still remains the doubt as to the action of concrete under impacts, vibrations, and repeated loads. While in the present state of our knowledge this doubt cannot be eliminated, the danger resulting therefrom may not extend further than to the structure itself. Steel is a material that is comparatively well understood at the present time; nevertheless the capabilities of steel are sometimes exceeded in railway bridges; when this happens the steel bridge falls without preliminary warning, carrying with it its load of passengers or freight. In the concrete arch, if the fac-

tor of safety chosen proved too low for the effects of impact, the first sign of failure would be a crack, which would not necessarily decrease the capacity of the arch to resist further impacts. But it must not be forgotten that the arch now bears a new relation to the steady loads, and the suddenly imposed loads; the tension at the point of cracking is eliminated, but the horizontal thrust and the stresses at other points may be increased. The arch should therefore be designed to meet this emergency; if cracking should then occur, the arch could be replaced at leisure. The crack is the safety valve and at the same time the danger signal.

This is not to be construed as an argument in favor of hinging the arch at the crown or haunches; for the introduction of such a hinge would remove the possibility of the danger signal, without increasing the strength of the arch under steady loads; moreover, a hinge in an arch is a continual nuisance, both in construction and maintenance.

It may be argued that if concrete is to be used for railway arches, it would better be re-enforced with steel. Unfortunately the strength of such a combination has never been satisfactorily tested. The Austrian test on a Melan arch of 13 ft. span showed a high efficiency; but in that arch the proportion of steel to concrete was much greater than is usual or economical in such structures. The steel provided the principal support to the load; the arch was, in fact, a steel arch re-enforced by concrete, and while it might be advocated on the ground of efficiency, an arch of steel alone would prove as efficient and quite as economical.

When concrete and steel in combination are subjected to a direct stress, the intensity of stress on the two materials is in inverse proportion to their coefficients of elasticity, provided the elastic limit of neither material is exceeded. Thus, if the coefficient of elasticity for concrete be assumed to be 3,000,000, and that of steel to be 30,000,000 lbs. per square inch, the ratio of the stress per square inch on the two materials will be as ten to one. If for the concrete the stress be 300 lbs. per square inch, then for the steel it will be 3,000 lbs. per square inch. When the maximum tension of 60 lbs. per square inch is reached for the concrete, the tension in the steel will be but 600 lbs. per square inch. And that stress in the steel cannot be exceeded without endangering the concrete. If the two are to be economically used in combination, therefore, they should be so proportioned that one will serve as a reserve in case of failure of the other. One at least of the two materials should be proportioned to sustain the load without the assistance of the other.

[TO BE CONTINUED.]

TECHNICAL.

Manufacturing and Business.

The Chicago Pneumatic Tool Company reports that April was the largest month that it has ever had, both in the number of orders received and the number of tools ordered.

James A. Ellis, Hammond Building, St. Louis, has severed his connection with the Thornburgh Coupler Attachments Co., and is about to become interested in another attachment, for which he will have the exclusive sale in the United States and Canada.

The New York, Ontario and Western has recently installed in its shops a duplex steam driven air compressor built by the New York Air Compressor Co. A large duplex air compressor has been ordered from the same company to be used in connection with the Standard Railroad Signal Co.'s installation on the New York Central & Hudson River. This machine is the first of two to be located in the engine room at the Grand Central Station.

Edward C. Bates, recently with the Crosby Steam Gauge & Valve Co., has been appointed Eastern representative of the Ewald Iron Co. of St. Louis, with offices in New York City. Mr. Bates for a number of years represented the railroad department of the Crosby Company.

The Monarch Brake Beam Co. has removed its New York office to 39 Cortlandt street.

The 1,600 cars recently ordered for the Bangor & Aroostook are to be equipped with Smillie couplers. This decision was arrived at after a number of trials of the Smillie coupler, all of which proved satisfactory.

The Link-Belt Machinery Co., Chicago, has sold to the Goodman Mfg. Co. that part of its business known as the electrical mining machinery department. The business of this department has so increased during recent years that it exceeds the capacity of the Chicago plant, and it was considered advisable to retire from the electrical machinery business. All unfilled contracts and orders have been transferred to the Goodman Mfg. Co. The new company will have offices and works at Chicago, and the officers are as follows: Frank S. Washburn, President; Elmer A. Sperry, Vice-President; Herbert E. Goodman, Treasurer and General Manager; Chas. H. Strawbridge, Secretary, and Chas. E. Davis, Superintendent.

Iron and Steel.

The Bethlehem Steel Co. has an order for crank shaft forgings for a contract in Australia.

The Standard Chain Co., Pittsburgh, has secured control of the Falls City Chain Co., at Jeffersonville, Ind., on the Ohio River. The plant contains 60 forges.

The Washburn Wire Co. has been organized, with a capital of $1,500,000, and has secured the wire plant of R. H. Wolff & Co., Ltd., on the East River front between 116th and 118th Sts., New York City. Chas. G. Washburn of Worcester, is interested.

Reports from Detroit state that a building and machinery has been secured for a steel tube factory for a company recently organized with a capital of $150,000.

The American Sheet Steel Co. has practically concluded negotiations to take over the sheet mills of the Republic Iron Works, owned by the National Tube Co., at a cost of about $350,000.

The prospectus of the Canada Foundry Co. has been issued. Of its total authorized capital stock, $250,000 7 per cent. cumulative preferred stock will be sold. The company proposes to make all kinds of architectural iron and railroad supplies. Frederick Nicholls, General Manager of the Canadian General Electric Co., is Vice-President. Among the directors are Wm. Hendrie of the Hamilton Bridge Co.; H. S. Holt of the Montreal Gas Co., W. H. Winslow and Sir William Van Horne.

One of the three plants closed at Joliet by the American Steel & Wire Co. was opened May 7. Work was also resumed at the Braddock, Pa., plant May 7.

The Bethlehem Steel Co. will replace the wrought iron shaft which broke recently on the Steamer "Puritan" of the New York, New Haven & Hartford Co.'s service, with a hollow forged steel shaft.

A New Railroad Club.

On Wednesday evening, April 25, twelve railroad men connected with roads entering Denver, Colo., met in that city and organized what will be known as the Rocky Mountain Railway Club. The object of this Club will be the advancement of knowledge concerning railroad operation, and the membership is to consist of persons interested in railroad matters generally. This gives a broad field to work in, and it is held that there is no good reason why the Rocky Mountain District should not support a progressive and useful organization similar to those at other railroad centers. The meetings will be held at Room No. 33, Union Depot, Denver, on the first Saturday after the 15th of each month. The officers elected for the first year are: President, J. H. Manning, Master Mechanic, Union Pacific, Cheyenne, Wyo.; First Vice-President, C. H. Quereau, Assistant Superintendent of Machinery, Denver & Rio Grande, Denver, Colo.; Second Vice-President, W. E. Fowler, Master Car Builder, Colorado & Southern, Denver; Treasurer, Frank Harris, Assistant Superintendent, Denver & Rio Grande, Pueblo, Cal. The Executive Committee consists of these officers and R. Ballance, General Foreman of the Burlington & Missouri River, Denver, Col.

A New Asphalt Company.

The National Asphalt Co. was incorporated in New Jersey, May 3, with an authorized capital stock of $15,000,000. The incorporators are Wendell P. Rice, James Murray Mitchell, George B. Hancord, Percy H. Brundage and Ansel L. White, all of New York.

The Bates Fire Door.

In the article on burning bituminous coal without smoke on the Southern Pacific, printed in the Railroad Gazette April 27, we illustrated a new furnace door which is being extensively used on that road. This door is made by the Bates Fire Door Co. of Paterson, N. J., under patents of Mr. F. L. Bates. The door proper is made in two sections. The upper section, commonly called the "trap," is always left open while the engine is working, and through this opening the fireman charges coal into the firebox. We are told that some remarkable results are being obtained by its use on many engines.

Steel-Tired and Cast-Iron Wheels.

The committee of the American Railway Master Mechanics' Association appointed to report on the Relative Merits of Cast-Iron and Steel-Tired Wheels requests information on this subject, giving, if possible, the cost per thousand miles of steel-tired wheels and cast-iron wheels, and the percentage of breakages for wheels in similar service. Replies should be forwarded to J. N. Barr, Mechanical Superintendent, B. & O. R'y, Mt. Clare, Baltimore, Md., by May 20.

Another Cement Plant.

Plans and specifications for a new cement plant for the Manitoba Union Mining Co. are being made. The plant will be located near Winnipeg, Man.

Steel Platforms.

The statement that the Rock Island is about to equip its passenger cars with steel platforms is substantially true. We learn on good authority that the Rock Island cars will be taken into shop as fast as possible and equipped with the Standard platform, made by the Standard Coupler Co. The latest issue of Poor's Manual gives the total passenger equipment of the Rock Island (including baggage and postal cars) as 418 cars. We have not ascertained how many of these are to be equipped with the steel platform. Mr. Wilson is quoted as saying that this is "One of the greatest improvements ever made in passenger equipment. The steel platforms with the wide vestibules make the nearest approach to perfection thus far attained." It is probable that the observed performance of the steel platform in collisions has had a good deal to do with this change. We saw recently a circumstantial official account of a collision at high speed on one of the western roads in which all of the cars were equipped with steel platforms, and none of them were seriously injured. It was the opinion of the Superintendent of Motive Power that but for these platforms there would have been a bad wreck.

THE SCRAP HEAP.

Notes.

On the Fort Worth & Denver an order has been issued forbidding the employment of any person in any capacity where his superior officer will be a relative.

On the street railroad, running through Shelton, Derby, Bridgeport, Milford and New Haven, Conn., a double daily parcel express service is now run. Special box cars, 35 ft. long, have been built for this business.

A local freight train, in the caboose of which were a number of passengers, was boarded by robbers near North Yakima, Wash., on the Northern Pacific, on the night of May 4, and several hundred dollars worth of valuables were taken. Having completed the robbery the highwaymen compelled the passengers to jump from the moving train. Two of the passengers were shot, but not fatally injured.

The street cars of St. Louis were practically all tied up, on May 7 and 8, by a strike of the motormen and conductors. An Tuesday there were a number of riots, and there were numerous injuries by clubs and brickbats.

A Chicago newspaper reports that a plan has been prepared for the establishment of a pension and relief department on the Chicago, Milwaukee & St. Paul. Details are given at considerable length, but it does not appear whether or not the plan has yet received approval, or even encouragement, from the officers of the company.

Traffic Notes.

The Wilmington (N. C.) Messenger, of May 3, reported shipments of 33 carloads of strawberries, northward, in one day.

It is reported that the Chicago, Rock Island & Pacific has increased the salaries of 400 ticket agents who were affected by the abolition of commissions.

The railroads of Minnesota have notified the State Railroad Commissioners that they will adopt the reduced tariffs for the transportation of grain which have been recommended by the Commission.

It is reported that shippers of certain iron commodities have already secured the restoration of commodity tariffs in both Trunk Line and Central

"Home Seekers,"

The Soo Line is now running home-seekers' excursions twice a month from the West to New York, Boston and other eastern points, the rate being one fare plus $2 for the round trip. It is understood that General Passenger Agent Callaway is more or less familiar with the fact that most of the people in the western states are pretty well satisfied with the homes which they now occupy, and are not likely to be found prospecting among the abandoned farms of New England or the barren wastes of the 84th ward of New York City for better locations; but he thinks that his competitors have acted unfairly in the matter of rates for westbound home-seekers' excursions, and so he is going to try a little eastbound experiment with a view to getting even with the other fellows. Buyers of tickets are not required to make affidavit that they spend any specific amount of time in looking for good places to settle, and it is understood that no objection will be made if most of the seekers fetch up at Newport, Atlantic City, Bar Harbor or the White Mountains, or even at a Broadway Theatre. If, after a time, they feel like again "seeking" their former western homes the Soo will be ready to receive them with open arms—and free tourist cars.

A Gasoline Locomotive.

Mr. Frank Stutzman, of Williamsport, Pa., has made a light car to be propelled by a gasoline motor, and he is now trying the vehicle on the Eagle's Mere Railroad. This road is 3 ft. gage.

Automatic Block Signals on the Alton.

The Hall Signal Co., of New York City, has closed a contract with the Chicago & Alton for putting up block signals on about 40 miles of the company's line, beginning at Chicago. This part of the line is all double track. The signals will be semaphores worked by electric motors and controlled by track circuits. The semaphores will stand normally in the danger or stop position and all switches will be provided with bell indicators and with connections by which they will set a signal in the stop position whenever the switch is set for the side track.

Telephones on the Erie.

The Erie road is equipping a large number of its block signal stations with telephones. On the Erie electrical communication between block signal cabins is had by means of bells, with the usual English bell code; so that, except where the signal cabin is at or near a station where the Morse telegraph is established, the signalmen have no way of communicating with one another over the wire except by the limited vocabulary of the bell code. The telephones are introducd to make up for this deficiency. They are worked over the same wire which is used for bell signals. The report that the Erie would

abandon the bells in some or all of its cabins and use nothing but telephones for block signaling is untrue.

The Kansas Railroad Law.

The Supreme Court of Kansas has decided that the populist railroad law, passed a little over a year ago, is unconstitutional. This law established the "Court of Visitation" to take the place of the Railroad Commission and clothed the Court with broad powers of rate regulation. It is said that the present decision leaves Kansas without any railroad legislation whatever. This decision is in line with one handed down several months ago by a Federal Court.

Freight Association Territory.

General Passenger Agent Daniels, of the New York Central, has just returned from a trip to Texas, California and Oregon; and he reports that in the principal cities through which he has passed the ticket scalpers are gradually giving up their business. The abolition of commission payments on tickets, which was agreed upon by the principal roads about four months ago, has been more widespread and better carried out than any similar movement of the kind for many years, and the scalpers are now feeling its force with a good deal of severity. Mr. Daniels says, however, that it is still desirable to have legislation enacted to completely suppress scalping. A press despatch from Buffalo, May 5, says that "a large proportion of the small army of ticket scalpers in Buffalo have gone out of business, closing their offices and shops on May 1."

Settlement of N. Y. C. Strike at Buffalo.

The strike of the shopmen and car-repairers of the New York Central at Buffalo was settled on Wednesday of last week, the company granting nearly all of the increases asked for by the men. Buffalo papers report that the wages of carpenters are increased from 14 and 16 cents an hour to 21 cents (they asked 22); repairers have their pay advanced from 13 cents to 16; car inspectors, $50 a month to $60; machinists, 20 cents an hour to 22 cents (they asked 22½); air-brake inspectors (inside), 15 cents to 19 cents (asked 20); air-brake inspectors (outside), $50 a month to $62.50 (asked $64.50); assistant foremen, $55 a month to $60; blacksmiths, 15 cents to 22 cents; laborers, 13 cents to 15 cents.

An officer of the road told a reporter that the increase of the payrolls of the Buffalo shops would amount to $4,000 a month; and that if similar advances were made in the other shops of the company the aggregate increase would be $500,000 a year.

The strikes of car repairers on other roads in Buffalo and of freight handlers on all the roads there appear to be still unsettled, though it is not apparent from the press despatches that they have caused serious inconvenience. The companies appear to have got the better of the men in the freight-houses by hiring enough green hands to avoid serious blockades. The Erie, the Lehigh Valley and the Lackawanna refused to grant the demands of their shopmen.

The freight conductors and brakemen of the Montana Central struck on May 1, and it appears that freight traffic was virtually suspended for about a week, when an agreement was made that the men should go to work and that the company would pay them according to the old or the new pay schedule, whichever one should prove the highest.

Railroad Organization.

A correspondent who saw the diagram showing the organization of the Pennsylvania Railroad, published in the Railroad Gazette, April 27, has something to say about the position of the engineer—whom he shall report to and who shall report to him. These points are not brought out in the Pennsylvania organization. In that diagram are instances of engineers reporting to persons who are not engineers, but in few instances does any engineer appear to report to another engineer. The diagram does not inform us who reports to the Chief Engineer or to the Engineer of Branch Lines, and as to the Engineer of Maintenance of Way no one reports to him except the Signal Engineer. The importance of the engineer on a railroad depends apparently on (first) whom he reports to and (second) who reports to him. On a certain railroad mentioned by this correspondent the Engineer of Maintenace of Way reports to the General Superintendent, and the roadmasters report to the division superintendents. He suspects that if the Engineer of Maintenance of Way reported to the Chief Engineer and the roadmasters to the Engineer of Maintenance of Way, the condition of the track might be improved.

Execution of Wattson's Murderer.

Edward J. Clifford, who murdered W. G. Wattson, Division Superintendent of the West Shore Railroad, at Weehawken, N. J., in March, 1896, was put to death at the Hudson County Jail in Jersey City on Tuesday of this week. Clifford's case had been repeatedly appealed and he had been sentenced to death five times. The final decision of the United Stated Supreme Court, refusing to reverse the action of the lower courts, was handed down last week.

Cooke Locomotives in Great Britain.

"Engineering" (London) in its issue of April 13 devotes considerable space to descriptions of some locomotives built by the Cooke Locomotive & Machine Company for coal roads in Wales. "The representative in the United States of Messrs. Thomas W. Ford & Co., of Westminster, was instructed to visit the leading firms, there to find one which would conform to English practice. The Cooke Locomotive & Machine Company, of Paterson, stated that while they would maintain the principle of the bar framing in the design of the engines, they would only carry this form from the leading end through to the firebox, where this form of framing would be bolted to the slab frame of the exact dimensions and design that might be required for engines for this country. Their willingness to accommodate English ideas in their locomotives resulted in Messrs. Ford & Co. obtaining orders from the Barry Railway and Port Talbot Railway & Docks Company of South Wales. The first order placed was by the former line for five engines in May, 1899, and these engines are now working on the Barry Railway, the results of the trial trips being satisfactory in every way. The Cooke locomotives are hauling between 500 and 600 tons over severe grades, the coal consumption being about 41 lbs. per mile. It has been frequently stated that American locomotives are extravagant in the consumption of fuel. This argument has hitherto been useful for the English makers. In this instance the first five engines that Messrs. Cooke have built for England show a coal consumption about equal to the average for English locomotives doing similar work. The average weight of a train on the Barry Railway is about 300 tons; while the Cooke locomotives are, as stated, hauling about 500 to 600 tons."

Grade Crossings in Newark, N. J.

Prof. George F. Swain, of the Massachusetts Institute of Technology, has made a study of the Lackawanna tracks at Newark, N. J., preparatory to advising the Board of Public Works whether the plans before them for abolishing grade crossings are practicable.

Block Signaling on the C. & N. W.

The Chicago & Northwestern is about to introduce the telegraph block system on its Peninsula Division. It is said that about 50 additional telegraph operators will be employed.

M. C. B. Couplers in England.

English papers of April 28 report that the Great Northern Railway has just completed a new train of passenger cars, to be put in service between London and Leeds, on which automatic couplers are used. It appears that the couplers are of the Master Car Builders' (vertical plane) type and are placed beneath the ordinary English screw coupling. In case one of these cars has to be coupled to one fitted only with the old style, the automatic coupler can be disengaged so as to hang down out of the way. The side buffers are so designed that they can be pushed back under the car out of the way when the automatic coupler is used. The new train consists of six passenger cars, each about 60 ft. long, and supported on two trucks. Uncoupling is effected by means of a chain extending from the coupler to the side of the car.

It is stated that the North Eastern, the North British and the Great Central are also fitting up trains with these couplers.

LOCOMOTIVE BUILDING.

The Missouri Pacific is said to be considering ordering some new locomotives.

The Chicago Great Western is reported as in the market for 12 more locomotives.

The Low Moor Iron Co. has ordered one engine from the Baldwin Locomotive Works.

The Great Northern of Canada has bought seven locomotives from F. M. Pease, Chicago.

The Wiggins Ferry Co. has ordered one engine from the Cooke Locomotive & Machine Co.

The Rio Grande Western is having two engines built by the Schenectady Locomotive Works.

The State Railways of Egypt have ordered 10 passenger and 10 switching engines from the Baldwin Locomotive Works.

The Indianapolis Union is having two six-wheel switching engines built by the Pittsburgh Locomotive & Car Works. They will have 19 x 24 in. cylinders, 50-in. driving wheels, and will weigh in working order 110,000 lbs. The boilers are to be of the Belpaire type, and carry a working steam pressure of 180 lbs. There will be 220 charcoal iron tubes, 2 in. in diam. and 11 ft. 1 in. long, and the fireboxes will be 32½ in. long and 103 in. wide, of Carbon steel. The tenders will have capacities for 3,500 gals. of water and four tons of coal. These engines are for July delivery, and will have Westinghouse-American air brakes, Gollmer bell ringers, Janney couplers, Handlan headlights, Ohio injectors, U. S. metallic packing, Coale muffled safety valves, Dean sanding devices, Detroit lubricators, A. French springs, and Latrobe steel tires.

The Southern has ordered two passenger and 10 consolidation engines from the Richmond Locomotive & Machine Works, in addition to the eight passenger engines referred to last week, and making in all 61 engines now being built by the Richmond Locomotive & Machine Works for the Southern. The passenger engines will have 21-in. x 28-in. cylinders; 72-in. driving wheels; extended wagon top boilers, with a working steam pressure of 200 lbs., and 295 tubes 2 in. in diam. and 14 ft. 6 in. long; the tender capacity will be 5,000 gals. of water. The engines will weigh in working order 156,000 lbs., with 116,900 lbs. on the driving wheels. The consolidation freight engines will have 21-in. x 28-in. cylinders; 60-in. driving wheels, and will weigh in working order 151,500 lbs., with 133,600 lbs. on the driving wheels. The boilers will be of the extended wagon top type, with a working steam pressure of 200 lbs. and 271 tubes 2 in. in diam. and 14 ft. 8 in. long. The tender capacity will be for 5,000 gals. of water.

The Chicago, Milwaukee & St. Paul has ordered 48 Vauclain compound 10-wheel freight locomotives from the Baldwin Locomotive Works. There are three sizes, to suit different conditions of service. Twenty-five engines will have 15-in. and 25-in. x 30-in. cylinders; 68-in. drivers; 200 lbs. steam pressure; a total weight in working order of 179,000 lbs., of which 133,000 lbs. will be on the drivers; driving journals, 9 in. x 12 in.; total wheel base of engine and tender, 55 ft., and boilers, radial stay wagon top type, 66 in. in diam. at the front. There will be 350 iron tubes, 2 in. in diam. and 15 ft. long; the fireboxes will be of Carbon steel, 42 in. wide and 120 in. long. A brick arch will be supported on water tubes. Sixteen other engines will differ from those described principally in that the piston stroke will be 26 instead of 30 in., and the weight on each driving wheel 20,000 instead of 22,000 lbs. Seven of the engines will have 13½-in. and 23-in. x 26-in. cylinders; 62-in. drivers; 200 lbs. steam pressure, and a total weight of 148,000 lbs., with 108,000 lbs. on the drivers; the driving journals will be 8 in. x 12 in., and the total wheel base of engine and tender 53 ft.; the boilers of the radial stay, wagon top type, will measure 60 in. in diam. at the front and have 300 iron tubes, 2 in. in diam. and 15 ft. long; the fireboxes will be 42⅛ in. wide and 103 5/16 in. long, with a brick arch on water tubes. All tenders will have a capacity for 6,000 gals. of water. The special equipment for all includes Worth steel boiler plates, Carbon steel firebox plates, Ulster staybolt iron, U. S. metallic packing, Standard steel tires for drivers, Cambria (Coffin process) axles and crank pins, Ohio injectors, Westinghouse air brakes, Leach sanders, Latrobe cast steel couplers and Barr chilled tender wheels.

CAR BUILDING.

The Maine Central has ordered 100 box cars from the Laconia Car Co.

The Gulf & Brazos Valley has ordered one combination car from F. M. Pease.

The Missouri Pacific has ordered four baggage cars from the American Car & Foundry Co.

The Narrangansett Pier is having one passenger car built by the Jackson & Sharp Co.

The Ward Lumber Co. has ordered three cars from the American Car & Foundry Co.

The Rawley Lumber Co. has ordered 20 logging cars from the American Car & Foundry Co.

The Mexican Central has ordered 10 box and six flat cars from the Illinois Car & Equipment Co.

The United Fruit Co. has ordered from the American Car & Foundry Co. 12 cars for carrying bananas.

The New Jersey Zinc Co. has ordered 10 ore cars of 80,000 lbs. capacity from the Pressed Steel Car Co.

The Seattle & International has ordered two cars for passenger service from the Barney & Smith Car Co.

The Algoma Central has ordered 50 more steel cars, of 100,000 lbs. capacity, from the Pressed Steel Car Co.

The Chicago Great Western has ordered three chair, three café and three baggage cars from Pullman.

The Chicago & Alton is having 20 cars built by the Pullman Co., in addition to the 12 recently referred to.

The Gila Valley, Globe & Northern has ordered one combination car and one express car from F. M. Pease, Chicago.

The Chicago, Milwaukee & St. Paul will build in its own shops 1,000 box cars, 500 stock cars and 200 wooden ore cars of 100,000 lbs. capacity.

The Carolina & Northwestern, a new road, is looking into the question of the rolling stock to equip the road. L. F. Nichols, of Chester, S. C., is General Manager.

The Colorado Springs & Cripple Creek District has ordered from the Barney & Smith Car Co. six passenger coaches, 53 ft. 3 in. long, two for August and four for October delivery; two combination passenger and baggage cars, 52 ft. long, one for August and one for October delivery; one 52-ft. baggage and express car for October delivery; one 52-ft. mail and express car for October delivery, and two passenger cars, 53 ft. 3 in. long, with observation ends, to be delivered in October. The special equipment includes Pencoyd steel axles, Westinghouse air brakes, National couplers, Pantasote window curtains, with Forsythe fixtures, Gold duplex steam heating apparatus, pressed steel journal box lids, Standard steel platforms and A. French springs. The cars will also have 36-in. steel-tired wheels.

BRIDGE BUILDING.

AKRON, O.—A viaduct is proposed over the Mill St. crossing in this city. Charles H. Isbell, City Clerk.

ANACONDA, MONT.—Reports state that funds have been raised by individual subscription for the proposed bridge across Missoula River. (April 12, p. 243.)

ATTICA, N. Y.—Bids are wanted May 25 by C. W. Buchholz, Chief Engineer, Erie RR., New York, for a bridge, as stated in our advertising columns.

AUBURN, MASS.—The Worcester & Webster St. Ry. will probably build a bridge over Dun's crossing in this town.

BINGHAMTON, N. Y.—The contract for the new Chenango St. viaduct has been let to J. Bradley for the substructure at $43,986, and the Elmira Bridge Co. for the superstructure at $64,591. The following are the bids received:

	Superstructure.	Substructure.
McGuire & Hall	$65,792.50	$47,679.50
Owego Bridge Co	64,623.25	46,502.50
Snare & Triest	65,096.00	51,211.00
Groton Bridge & Mfg. Co	66,808.75	44,306.00
Alabama Bridge Co	65,794.75	44,113.75
Penn Bridge Co	71,163.25	.....
New Jersey S. & I. Co	72,001.35	.....
Fort Pitt Bridge Co	72,473.00	.....
Toledo Bridge Co	79,209.25	.....
Youngstown Bridge Co	68,690.50	.....
King Bridge Co	72,047.50	.....
Berlin Iron Bridge Co	70,470.25	.....
Passaic Rolling Mills Co	69,116.75	.....
Elmira Bridge Co	64,591.00	.....
Fagan Iron Works	Bid only in part.	
J. Bradley	.....	43,986.00

BOSTON, MASS.—The Committee on Metropolitan Affairs has reported favorably the Broadway bridge bill for a bridge to cost $300,000.

BUFFALO, N. Y.—In the annual budget $20,000 is allowed for proposed bridge at Michigan St., over the Bleckwell Canal. The budget also contains an allowance of 22,635 for eliminating grade crossings. (May 4, p. 293.)

CHESTER, S. C.—The Carolina & Northwestern will need some steel bridges on a proposed extension. See "Railroad Construction" columns.

COLUMBUS, TEX.—The Southern Pacific bridge being rebuilt across the Colorado River was again destroyed last week.

EAST LIVERPOOL, O.—A bridge is proposed across Dry Run by the County Commissioners.

EUREKA, CAL.—The California & Northern has petitioned the Harbor Commissioners for a drawbridge across Eureka slough.

FORT WAYNE, IND.—The Nickel Plate has provided $190,000 for renewal of bridges this year.

GLENDIVE, MONT.—The bridge proposed over the Yellowstone River, by Dawson County, will be an iron structure 925 ft. long. C. L. Brown, Chairman County Commissioners.

GOFFSTOWN, N. H.—The Railroad Commissioners are considering abolishing the grade crossing of the Manchester & Milford RR. in Goffstown.

HAMILTON, ONT.—A new bridge is contemplated at York St.

HARDIN, COL.—The Union Pacific bridge over the South Platte River, four miles east of Hardin, was carried away by high water May 1.

HILLSBOROUGH, N. B.—Bids will soon be received for a bridge over the Hillsborough River by the Provincial and Dominion governments.

JERSEY CITY, N. J.—May 17 is the date for opening new bids for the steel bridge over the Pennsylvania RR. cut at Baldwin Ave. John P. Egan, Clerk. (May 4, p. 293.)

KANSAS CITY, MO.—Plans have been approved for the proposed Allen Ave. viaduct, which is estimated to cost between $75,000 and $80,000.

LEICESTER, MASS.—The selectmen have decided to rebuild the Auburn St. bridge. Reports state that bids are wanted.

MENDON, MICH.—A steel bridge, about 156 ft. long, with a 16-ft. roadway, will probably be built to replace a wooden structure near Mendon, by the County Commissioners.

MERIDIAN, MISS.—Bids are asked, until May 15, for a steel bridge over Ponta Creek. B. V. White, Clerk of the Board of County Supervisors.

MIDWAY, B. C.—The Canadian Pacific will build a bridge over the North Fork of the Kettel River near Midway, Yale District.

MILWAUKEE, WIS.—Reports state that plans have been made for the proposed Grand Ave. viaduct. This is a county structure.

MONTESANO, WASH.—The Auditor of Chehalis County is authorized to receive bids for rebuilding the Black River bridge on plans furnished by bidders.

MT. TOM, MASS.—The abolition of two grade-crossing in Mt. Tom, on the Boston & Maine, is estimated to cost $30,000.

NATCHITOCHES, LA.—Bids are wanted, June 11, by the Natchitoches Railway & Construction Co., for its proposed bridge over the Red River at Grand Ecore, La., about three miles above this place. D. C. Scarborough, President.

NEW BEDFORD, MASS.—J. B. Jean proposes to build a bridge over the Acushnet River to Fairhaven.

NEW YORK, N. Y.—It is said that the contracts have practically been agreed on between the New York Connecting RR. Co. and the Pennsylvania Steel Co. for the steel required for the bridge and trestlework for the Connecting Railroad which is further described on another page.

The plans for the East River bridge, known as bridge No. 3, have been completed. The bridge will span the East River from Washington and Adams Sts., Brooklyn, to Pike Slip, Manhattan Borough. The entire length will be 9,335 ft. The length between towers is 1,465 ft.

NIAGARA FALLS, N. Y.—Bids are wanted at the office of Edward A. Bond, State Engineer and Surveyor, Albany, N. Y., with plans and specifications for a bridge over the Niagara River, connecting the mainland and Goat Island. The appropriation is $120,000. The bridge may be steel arch or wholly of stone, or of stone and concrete, or of the latter character with a stone facing. (April 27, p. 278.)

OGDEN, UTAH.—The Southern Pacafic will build a trestle, about 25 miles long, across the northern end of the Great Salt Lake. A surveying corps under the direction of D. D. Griffith, of Oakland, Cal., is now in the field selecting a route for the cut-off.

PATERSON, N. J.—F. R. Long Co., New York, have submitted plans to the Freeholder's Committee for a birdge over the Passaic River, at Sixth Ave. It will be 280 ft. long, of four steel spans.

PAULDING, O.—A steel bridge is proposed across Prairie Creek. Floyd Atwill, County Auditor.

PITTSBURGH, PA.—John M. Hastings will build a viaduct on his property.

Surveys are being made to elevate the Panhandle tracks in Pittsburgh and Allegheny, also for a new bridge over the Allegheny River, which are necessary for an approach to the new Union Station in Pittsburgh.

A bridge is necessary for the Western Pennsylvania Division of the Pennsylvania RR., in connection with changing the course of Pine Creek.

RAPID CITY, MAN.—C. A. Milliken, of Winnipeg, is in Rapid City in connection with a proposed bridge over Little Saskatchewan River at Rapid City.

RED LAKE FALLS, MINN.—We are informed that the Great Northern will probably build a bridge at this place.

RIPON, CAL.—The Southern Pacific has let a contract to the Phœnix Bridge Co. for the superstructure for a 200-ft. steel bridge over the Stanislaus River. It will be of two spans 100 ft. each. The S. P. will build the foundations and erect the bridge.

ROCKFORD, ILL.—Bids are wanted, May 16, for a plate girder bridge over Kent Creek at State St. Edwin Main, City Engineer.

ST. ALBINS, VT.—The Edge Moor Bridge Works, Wilmington, Del., has a contract for 11 spans for the Northern Division of the Central Vermont Ry., between Windsor and St. Albans, Vt. The Detroit Bridge Co. has the contract for 25 spans between Brattleboro, Vt. and New London, Conn. Ward & Douglass, of Montpelier, Vt., will build the masonry on the Northern Division. The contract for the masonry on the Southern Division has not been let.

SAN FRANCISCO, CAL.—The Board of Supervisors have been petitioned to appropriate $16,000 for a steel bridge across the Southern Pacific RR. cut at Miguel and Thirty-fourth Sts.

SHEBOYGAN, WIS.—The Chicago, Milwaukee & St. Paul has some bridge work in contemplation in this city.

SIMCOE, ONT.—Plans are being made by W. H. Fairchild, County Engineer, for a bridge over Big Creek, one mile north of Delhi.

SOUTH WOODSLEE, ONT.—The Michigan Central Ry. wil build a new bridge over Belle River.

URBANA, ILL.—Bids are wanted, May 15, for seven small highway bridges on stone masonry. Ira O. Baker, Champaign, Ill., may be addressed.

UTICA, N. Y.—The proposed bridge at Washington, St., Utica, will be a liftbridge over the Erie Canal, with a span of between 80 and 90 ft. It will be of steel with a wooden floor. The State Engineering Department is at work on the plans. (April 12, p. 243.)

WASHINGTON, D. C.—A bridge across Rock Creek, from Quarry Road entrance to the National Zoological Park, is provided for in the District bill, at a cost of $22,000, one-half to be paid by the District.

YREKA, CAL.—Bids are wanted, May 19, with plans and specifications, for a bridge across the Little North Fork of the Salmon River. Bids are also wanted the same date for a bridge across Klamath River. (April 27, p. 278.) Robert Rankin, Clerk to the Board of Supervisors.

ZANESVILLE, O.—The $200,000 bridge bonds to be sold May 15, by Muskington County, are for rebuilding the old Y bridge at the junction of the Muskingum and Licking Rivers at Zanesville. It is stated that the Osborn Co., of Cleveland, will make the plans. James L. Starkey, County Auditor.

Other Structures.

BALLSTON, N. Y.—The Delaware & Hudson has let a contract to Reardon & Burnham, of Glens Falls, N. Y., for a new freight house, 175 x 35 ft., on Grove St. A new passenger station will be built during the summer.

BEAVER DAM, WIS.—The plant of the Beaver Dam Malleable Iron Co. was destroyed by fire May 1. The loss is $100,000. The freight depot of the Chicago, Milwaukee & St. Paul and five box cars were also burned.

COLORADO SPRINGS, COL.—A new station is proposed by the Denver & Rio Grande in Colorado Springs.

COLUMBIA, TENN.—The Louisville & Nashville will build a new passenger station at this place at a cost of $18,000.

DENTON, TEX.—The contract for the new station of the Texas & Pacific has been let to William Bryce, of Fort Worth, at $16,000. The building will be 125 ft. long, and will be of brick with stone trimmings, and have steel ceilings and concrete floors. The station will be used jointly by the T. & P. and the Missouri, Kansas & Texas. The M., K. & T. Dallas Branch is on the East side of the building and the joint tracks of the T. & P. and M., K. & T. are on the West side. The main waiting-room will be 30 x 40 ft. Special waiting-rooms for colored people are provided. The baggage-room will be 25 x 30 ft., and the ticket and telegraph offices, each, are 17 x 18 ft.

DUBLIN, GA.—The Wrightville & Tennille RR. Co. is to build a new station at Dublin. The Macon, Dublin & Savannah RR. will rebuild and enlarge its present station at Dublin, both buildings to be finished in about 60 days.

HILLYARD, WASH.—The machine shop of the the Great Northern at Hillyard will be extended to double the capacity.

INDIANAPOLIS, IND.—The Central Steel Co. will build a plant to make merchant steel.

JACKSON JUNCTION, MICH.—The Michigan Central Ry. will build a new shop at Jackson Junction at a cost of about $50,000. An electric lighting and steam heating plant will also be added at a cost of $30,000.

JERSEY CITY, N. J.—Work is begun at Black Tom by the Lehigh Valley RR. on a new grain elevator to replace the one recently destroyed by fire at Perth Amboy.

KANSAS CITY, MO.—The Benniwell-Calvin Iron Co. has been incorporated, with a capital of $100,000, by John Calvin, F. B. Benniwell and W. H. Grant.

LEETONIA, O.—The blast furnace and coke plant of the Cherry Valley Iron Works at this place have been bought by Joshua W. Rhodes and Ledlie W. Young, of J. W. Rhodes & Co., Pittsburg iron and steel brokers; Edwin N. Ohl, of New Castle, of the Republic Iron & Steel Co., and Robert W. Flenniken, of the Pennsylvania Car Wheel Co. A new company, known as the Cherry Valley Iron Co., has been organized, with a capital of $350,000. About $100,000 will be spent on improvements.

MARSHALL, TEX.—The contract for the new roundhouse and car shops of the Texas & Pacific has been let to J. W. Thompson, of St. Louis, Mo. The improvements will cost $150,000. (April 12, p. 244.)

MAUCH CHUNK, PA.—The Lehigh Valley will soon receive bids for a new depot at East Mauch Chunk. (May 9, p. 160.)

MICHIGAN CITY, IND.—The contract for the Michigan Central freight house at this place has been let to N. J. Rogers, of Detroit, Mich. It will be 30 ft. wide and 211 ft. long. Work is to be begun May 14.

MONESSEN, PA.—The contract for the new station for the Pittsburgh & Lake Erie, at this place, is let to Breitweisser & Co., of Pittsburgh. (May 4, p. 294.)

MONTEREY, MEX.—William White, Jr., of Pittsburgh, Pa., is having plans made for a blast furnace and open-hearth steel plant, to be built at Monterey.

OTTAWA, ONT.—The Ottawa & New York Ry. proposes to move its car and machine shops from Santa Clara, N. Y., to Ottawa, Ont. Plans for the new shops have not been fully decided upon.

The Canadian Pacific Ry. station in Ottawa will be rebuilt near the old site, but larger.

PITTSBURGH, PA.—In another part of this issue we show an elevation of the union station at Pittsburgh. Probably before the end of the month bids will be wanted for the removal of the present station.

It is said that the Baltimore & Ohio is planning to build a new passenger station for Pittsburgh.

The American Axe & Tool Co. has bought 38 acres of land on the river front, near Glassport, upon which it is proposed to build a $500,000 plant.

ROGERS PASS, B. C.—The station, shops and other buildings of the Canadian Pacific at this place will be removed one mile west from the present site.

RONDOUT, N. Y.—The Ulster & Delaware will build new stations at East Meredith, Davenport Center and Oneonta. Bids are wanted on the work.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xi.)

Freight Claim Association.

The ninth annual convention of the Freight Claim Association was held in St. Louis, Mo., May 3 and 4. The following officers were elected: President, R. L. Russell of the Philadelphia & Reading, and Secretary and Treasurer, Warren P. Taylor.

The International Railroad Congress.

We published, last, week, a complete list of the subjects of reports being made at this Congress, together with the names of some of the reporters. This will be found on page 282 in our issue of May 4. The Congress will open Sept. 20 and close Sept. 30.

St. Louis Railway Club.

At the meeting of the St. Louis Railway Club, Friday afternoon, May 11, at the Southern Hotel, St. Louis, Mr. J. A. Gohen, Master Car Painter, of the Cleveland, Cincinnati, Chicago & St. Louis, read a paper entitled, "Classification and Numbering of Passenger and Freight Equipment."

Western Railway Club.

The annual meeting of the Western Railway Club will be held Tuesday afternoon, May 15, at the Auditorium Hotel, Chicago. At that time Prof. L. P. Breckenridge, of the University of Illinois, will present a paper entitled, "Locomotive Road Tests; How They Should Be Made." At this meeting the officers for the year will be elected.

Western Society of Engineers.

A meeting of the Western Society of Engineers was held Wednesday evening, May 2, in the Society rooms, Monadnock Block, Chicago. A paper was presented by Mr. A. C. Schrader, Chief Engineer for the West Chicago Park Commissioners, entitled "Parks and Boulevards." This paper was only briefly discussed. At the next meeting, May 16, Mr. O. Chanute's paper, on "Preservative Treatment of Timber," will be brought up for further discussion.

Central Railway Club.

The next regular meeting of the Club will be held at the Hotel Iroquois, Buffalo, N. Y., Friday, May, 11, at 10 A.M.

Dynamometer Car Tests.

Prof. L. P. Breckinridge of the Department of Mechanical Engineering of the University of Illinois will address the Club upon "The Dynamometer Car in Tests for Railroads." No man in the Middle-west is more familiar with the scientific side of railroad construction than Prof. Breckinridge. He holds close relations with the Illinois Central and the Cleveland, Cincinnatti, Chicago & St. Louis railroads, both of which have, under his direction, built railroad testing cars which have been or are being equipped by the University of Illinois, for the purpose of testing track construction, engines, etc.

Special Committee Reports.

Reports postponed from the March meeting will be presented as follows:

"Best Form of Construction, and Methods of Ventilating, Heating and General Equipment of Roundhouses." Committee: W. H. Marshall, Chairman; George W. West, C. H. Potts.

"Standard Box Cars; technical details of construction along the lines recommended by the Committee on Typical Dimensions whose report was presented at the January meeting." Committee: L. T. Canfield, H. F. Ball.

Institution of Civil Engineers (British).

At the annual meeting of the Institution of Civil Engineers the result of the ballot for the election of officers was as follows: President, Mr. James Mansergh; vice-presidents, Sir William White, K.C.B., Mr. Charles Hawksley, Mr. J. C. Hawkshaw, M.A., and Mr. F. W. Webb; other members of council, Mr. Barton (Dundalk), Mr. Horace Bell, Sir Alexander Binnie, Mr. B. Hall Blyth, M.A. (Edinburgh), Dr. Henry Taylor Bovey, M.A. (Montreal), Mr. C. A. Brereton, Mr. T. Forster Brown (Cardiff), Mr. R. Elliott Cooper, Mr. G. F. Deacon, Mr. W. R. Galbraith, Mr. G. H. Hill, Mr. J. C. Inglis, Mr. Alexander Izat, C.I.E. (Gorakhpur, India), Dr. Aleander B., W. Kennedy, Sir James Kitson, Bart, M.P. (Leeds, Mr. A. G. Lyster (Liverpool), Mr. John Allen McDonald (Derby), Mr. T. Pritchard Martin (Dowlais), Mr. William Matthews, Sir Guilford L. Molesworth, K.C.I.E., Mr. Alexander Siemens, Mr. Thomas Stewart (Cape Town), Mr. John I. Thornycroft, Mr. William Thwaites, M.A. (Melbourne), Professor W. C. Unwin, B.Sc., and Sir E. Leader Williams (Manchester).

The Council of the Institution of Civil Engineers have made the following awards for papers read and discussed before the institution during the past session: A George Stephenson, medal, and a Telford premium to Sir Lowthian Bell, Bart, LL.D., F.R.S.; Telford medals and premiums to Messrs. H. H. Dalrymple-Hay, B. M. Jenkin, F. W. Bidder, and F. D. Fox; a Watt medal and a Telford premium to Mr. J. Dewrance; a Crampton prize for Sir Charles Hartley; and Telford premiums to Messrs. C. N. Russell and R. A. Tatton.

PERSONAL.

(For other personal mention see Elections and Appointments.)

—Mr. William G. Blair, Treasurer of the Emmittsburg Railroad, died at his home in Emmittsburg, Md., May 4.

—Mr. James H. Phyfe, who recently resigned as Superintendent of the Harlem Division of the New York Central & Hudson River, died May 3, from pneumonia.

—Mr. Willis C. Squire, Engineer of Tests of the Atchison, Topeka & San Fe Ry., has resigned to accept a similar position with the St. Louis & San Francisco RR.

—Mr. Charles P. Haughian died recently at his home in Brooklyn. He was President of the Chrome Steel Co., and for years has been known as an original and successful worker in certain lines of the production and application of steel. He started the Chrome Steel Works in 1865. Before that he had been connected with the American Arms Co., which had supplied guns to the Government during the War of the Rebellion. He was fifty-eight years old, a member of the Engineers' Club of New York, the Technical Club of Chicago, and numerous other clubs and societies. He was born in Ireland, but came to this country as a small boy.

—Mr. Paul Jones has recently been transferred to the position of Engineer of Maintenance of Way on the Richmond Division of the Pennsylvania Lines West of Pittsburgh, at Richmond, Ind. He was born at Hartford City, Ind., Sept. 6, 1867, and educated at Earlham College, Richmond, Ind. His entire railroad service has been with the Pennsylvania Company. He entered service in June, 1888, as rodman, and was promoted to Assistant Engineer of Maintenance of Way on the Indianapolis Division July 1, 1895. Three years later he became Engineer of Maintenance of Way on the Indianapolis & Vincennes and Indianapolis Terminal Division, from which position he was transferred on April 1 last.

—Mr. R. H. Soule has opened an office for private practice as consulting and designing mechanical engineer at 71 Broadway, New York City. Mr. Soule will naturally expect to give particular attention to railroad machinery, rolling stock and shops, but obviously he is prepared to work efficiently in a field even more extended. Of course, it is quite unnecessary to introduce Mr. Soule to the readers of the Railroad Gazette. He is a graduate of Harvard and of the Massachusetts Institute of Technology and has had a vast railroad experience, ranging all the way up to General Manager. Latterly he has been in the service of the Baldwin Locomotive Works, for which concern he traveled extensively in Europe, Asia and Africa.

—Mr. W. White, the new Master Mechanic of the Lake Erie & Western, was born at Ionia, Mich., Jan. 26, 1863. He served his apprenticeship with the Detroit, Lansing & Northern at Ionia. After reading law for three years, he entered the service of the Pennsylvania Company as machinist at Fort Wayne. Eighteen months later he was placed in charge of the Air Brake Department at Fort Wayne, and continued in that capacity for two years. He then went to Wellsville, O., as Assistant General Foreman of the Cleveland & Pittsburgh Division, where he remained seven years. He then entered the service of the Illinois Central as General Foreman at Freeport, Ill., and after six months' service was transferred to a similar position at Paducah, Ky. He there continued six months more, when he was sent to Memphis, Tenn., as Master Mechanic. He resigned that position to accept a similar one with the Lake Erie & Western.

ELECTIONS AND APPOINTMENTS.

Arkansas Southwestern (Successor to the Southwestern Arkansas & Indian Territory).—The officers of this company are: President, Corwin H. Spencer, St. Louis, Mo.; Vice-President and General Manager, J. A. Woodson, Little Rock, Ark., and General Freight Agent, P. B. Price, Smithton, Ark.

Atchison, Topeka & Santa Fe.—The Western Oklahoma, the New Mexico and the Rio Grande Divisions have been consolidated, and C. M. Taylor, heretofore Division Master Mechanic at Raton, N. M., has been appointed Division Master Mechanic of the new division, with headquarters at La Junta, Col.

Central Vermont.—G. B. Reeve having resigned, the position of General Traffic Manager has been abolished. John W. Loud has been appointed Freight Traffic Manager, with headquarters at Montreal, Que. J. E. Dalrymple has been appointed General Freight Agent, with headquarters at St. Albans, Vt., succeeding John Pullen, resigned to go to the Grand Trunk.

Chicago & Alton.—At a meeting of the stockholders, held May 5, J. Stillman, G. J. Gould, N. B. Ream and J. J. Mitchell were elected Directors. F. W. Bridges, heretofore Car Accountant, has been appointed Superintendent of Car Service, with headquarters at Bloomington, Ill. Effective May 1. The position of Car Accountant is abolished. C. M. Mendenhall, heretofore Superintendent of Motive Power at Philadelphia, Pa., of the Philadelphia, Wilmington & Baltimore, has been appointed Superintendent of Motive Power of the C. & A., at Chicago, Ill. Effective May 15.

Chicago & Eastern Illinois.—H. J. Buck, heretofore Trainmaster of Danville, Ill., has been appointed Division Superintendent, with headquarters at St. Elmo, Ill., succeeding R. D. Fowler, resigned.

Colorado Midland.—Geo. W. Ristine, President, has resigned, effective July 1.

Crystal.—P. R. Holbach has been appointed Superintendent, with headquarters at Crystal City, Mo., succeeding E. Brown.

East Tennessee & Western North Carolina.—James E. Lawton has been appointed Superintendent, with headquarters at Cranberry, N. C., succeeding C. H. Nimson, resigned. Effective May 1.

Erie.—Charles H. Moore has been appointed First Assistant Engyineer (26 Cortlandt St., N. Y.) and Mason R. Strong, Bridge Engineer (21 Cortlandt St., N. Y.) of this company, the Chicago & Erie and the New York, Susquehanna & Western.

Grank Trunk.—John Pullen, heretofore General Freight Agent of the Central Vermont, has been appointed General Freight Agent of the G. T. G. T. Bell, heretofore First Assistant General Passenger Agent, has been appointed General Passenger Agent at Montreal, Que. G. W. Vaux succeeds Mr. Bell as Assistant General Passenger Agent at Chicago, Ill., and Mr. Vaux in turn is succeeded by H. G. Elliott as Assistant General Passenger Agent at Montreal, Que.

International & Great Northern.—The position of Superintendent of Bridges and Buildings has been abolished. A. L. Bowers has been appointed Superintendent in charge of all civil engineering and also in charge of the Transportation Department, with headquarters at Palestine, Tex.

Interstate Car Transfer.—Wm. McClellan has been appointed Superintendent, succeeding W. C. Norris.

Kansas City, Mexico & Orient.—The officers of this company are: A. E. Stilwell, President; Enrique C. Creet, Chihuahua, Mex., First Vice-President; S. A. Witherbee, Detroit, Mich., Second Vice-President; W. W. Sylvester, St. Louis, Third Vice-President; Alonzo Fernandez, St. Louis, Fourth Vice-President; W. A. Rule, Kansas City, Treasurer, and M. Nevin, Kansas City, Secretary. (See "Railroad Construction" column, April 20, p. 263.)

Kansas City Southern.—E. Holbrook, heretofore Chief Engineer of the Louisville, Evansville & St. Louis, has been appointed Chief Engineer of the K. C. S., with headquarters at Kansas City, Mo.

Los Angeles Terminal.—H. S. McKee has been appointed Auditor, effective May 1. Mr. McKee will also act as Assistant to the Superintendent. Effective May 15.

Missouri Pacific.—The Three Vice-Presidents' duties are defined as follows: Frank Jay Gould, recently elected First Vice-President, has been put in charge of the affairs of the company in the East, under the immediate direction of President George J. Gould. Second Vice-President, Charles G. Warner, is to have general supervision in the West, particularly of the legal traffic and commercial business, and Russell Harding, Third Vice-President and General Manager, is to exercise jurisdiction over the operating department and construction work. Their jurisdiction also extends over the St. Louis, Iron Mountain & Southern.

W. Q. Morcom has been appointed Auditor of Freight Receipts and H. H. McIntyre Auditor of Passenger Receipts of this company and the St. Louis, Iron Mountain & Southern. Effective April 25.

New York & New Orange.—H. A. Dankel has been appointed Superintendent, succeeding C. A. Millard.

Pacific & Idaho Northern.—J. Campbell has been appointed General Freight and Passenger Agent.

Philadelphia & Brigantine.—C. R. Van Etten has been appointed General Manager, with headquarters at Brigantine, N. J.

Pine Bluff & Western.—W. T. Radford has been appointed Superintendent, succeeding T. F. Doyle, resigned.

Pittsburgh & Fairmont Short Line.—The officers of this newly incorporated company are: President, T. W. Fleming; Secretary, O. S. McKinney, and Treasurer, A. Howard Fleming. The Directors, in addition to those above mentioned, are: C. E. Manley and T. A. Neil.

St. Paul & Duluth (Northern Pacific).—Charles S. Mellen, President of the N. P., also Daniel S. Lamont, Vice-President; Charles W. Bunn, General Counsel, and Edward D. Adams, Director, have been elected Directors of the S. P. & D.

San Francisco & San Joaquin Valley (A., T. & S. F.).—The headquarters of Division Superintendent A. D. Schindler have been removed from Stockton, Cal., to Fresno, Cal.

Santa Fe & Grand Canon (A., T. & S. F.).—G. A. Greene has been appointed General Freight and Passenger Agent.

Seattle & International.—R. T. Bretz has been appointed General Freight and Passenger Agent, succeeding H. E. Danz.

Swift Refrigerator Lines.—O. M. Stimson has been appointed Master Car Builder.

Utah & Pacific.—T. R. Ellerbeck has been appointed General Superintendent.

Wheeling Bridge & Terminal.—Otto Schroll, Engineer Maintenance of Way, in addition to his present duties, has been appointed Superintendent, succeeding J. E. Taussig.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ARKANSAS ROADS.—Willard E. Winner, of Kansas City, Mo., is reported building a railroad from Buffalo City, Ark., to zinc beds near that city.

ATLANTA, KNOXVILLE & NORTHERN.—Grading is reported begun on a branch seven miles long near Ducktown, Tenn., to the mines of the Ducktown Coal & Copper Co.

AURORA, BATAVIA & GENEVA.—This company was incorporated in Illinois, May 3, with a capital stock of $10,000, to build a railroad from the south line of Aurora Township to the south line of Geneva Township in Kane County. The incorporators and directors are: U. P. Hord, W. A. Hartsburg, Aurora; Thomas Snow, Batavia; John H. Miller, Geneva, and Francis Y. Kelly, Chicago.

BALTIMORE & OHIO.—An officer writes that there is no truth in the report that the company will build from Cherry Run, W. Va., north about 25 miles to McConnellsburg, Pa. (April 27, p. 279.)

Right of way is reported being secured for an extension of the Savage branch from Savage, Md., north about three miles to Guilford.

BRITISH COLUMBIA ROADS.—Messrs. Bodwell & Duff of Victoria, B. C., have given notice of application to the Legislature of British Columbia for an act to incorporate a company to build a railroad from a point near the outlet of Kamloops Lake, thence to the plateau of the Bonaparte River, thence to a point on the Carriboo road, thence northerly to a point near Williams or Antler Creek in the Carriboo District, with a branch to the confluence of the Quesnelle and the Fraser rivers.

They have also given notice for an act to incorporate a company to build a railroad from a point on Kitamaat Inlet in the Coast District of British Columbia to Hazleton on the Skeena River in the Cassiar District, B. C., and to build and operate electric tramways on all its branches.

Messrs. Robertson & Robertson, of Victoria, B. C., are making application to the British Columbia Legislature for an act to incorporate a company to build a railroad from a point at or near Taku Arm in the Cassiar District, B. C., at the junction of the Atlintoo River with the waters of Taku Arm; thence along the northern side of the said river to a point on Atlin Lake near the outlet of the river, and to build tramways and branches.

This firm is also applying for power to build a line from the point where the Dalton trail crosses the northern boundary line, thence southerly to the village of Kuchwan or the nearest point on the boundary line to the shores of the Lynn Canal, and to build branches and tramways to be operated by steam or electricity.

Messrs. Davis, Marshall & McNeil of Vancouver, B. C., are applying to the British Columbia Legislature for an act to incorporate a company to build a railroad from a point on Johnstone Strait, Vancouver Island, near Chatham Point, thence south to a point near Upper Campbell Lake; also from a point on Johnstone Strait, a short distance east of Bear River, thence south to a point near the north end of Bear Lake, with power to build electric tramways as branch lines, wharves, docks, etc.

They are also applying for an act to incorporate a company to build a railroad from a point on the line of the Canadian Pacific, near Vancouver, B. C., to a point on the Westminster Branch of the same road near New Westminster.

BROOKSVILLE.—Surveys are begun for an extension of this line southeast about 50 miles to West Liberty, Morgan County, Ky.

BURLINGTON, CEDAR RAPIDS & NORTHERN.—J. E. Johnson, of Cedar Rapids, Ia., is reported to have the contract for the extension from Germania, Ia., northeast 44 miles to Albert Lea, Minn. (Dec. 1, 1899, p. 835.)

CAROLINA & NORTHWESTERN.—Surveys are in progress for the extension from Lenoir, N. C., to the Tennessee boundary. The building of this extension is an assured fact. Contracts for grading will be let when the surveys are done. The maximum grades will be about 1 per cent., and the maximum curves about 8°. As far as possible it is proposed to build stone culverts. (May 4, p. 295.) New securities for the reorganization plan are already issued and the work will progress as rapidly as possible. (Official.)

CHICAGO & EASTERN ILLINOIS.—B. F. Johnston & Co. have taken the contract to grade a branch from Cypress, a station on the new extension from Marion, Ind., to Thebes, to run southeast about 15 miles to Joppa.

CHICAGO & NORTHWESTERN.—Reports come from Iowa that an extension is proposed from Kingsley, Ia., on the Moville branch, to run northwest about 40 miles via Merrill to Hawarden, there to make connection with the South Dakota line.

Paulson, Richards & Co., of Minneapolis, Minn., are reported to have a contract for an extension from Perkins, Mich., into timber belt along White Fish River, 23 miles.

CHICAGO & WABASH VALLEY.—A new incorporation has been made in Indiana to extend this line as far south as Templeton, in all about 55 miles. The road was completed last year from Kersey south about 20 miles to Pleasant Grove. (Sept. 29, 1899, p. 685.)

CUBA COMPANY.—This company, recently organized to build and develop railroads in Cuba, is reported to have secured options on the following roads: The Sagua RR., the Caibarien, the Savinlala, the Cienfuegos and the Jucaro line. (May 4, p. 295.)

DELAWARE VALLEY & KINGSTON.—At the annual meeting of the Anthracite Coal Operators' Association, held in New York City May 2, a resolution was adopted pledging the support of the Association to this line. It was stated that the road could be completed within eight months. It is proposed in the interest of the Pennsylvania Coal Co., and other independent mine owners, to run along the old Delaware & Hudson canal bed to tidewater at Kingston, N. Y. Wm. V. S. Thorne of 1 Broadway, New York, is President. (April 27, p. 279.)

DES MOINES & NORTHERN.—This company was incorporated in Iowa, May 1, with a capital stock of $50,000, to build a line from a point near Lineville, Wayne County, on the Missouri boundary line, north through Des Moines to the northern boundary of the State. Preliminary surveys are to be begun in a very few days. The Directors and incorporators are: Arthur Reynolds, President of the Des Moines National Bank; N. E. Coffin, Attorney for the National Life & Trust Co.; J. H. Blair, Secretary of the Iowa Loan & Trust Co.; J. H. Phillips and I. K. Wilson, all of Des Moines, Ia.

HIDALGO & NORTHEASTERN.—A press report from Tampico, Mex., announces that the Belgian syndicate which has bought this road will begin work about Aug. 1 of extending it from Pachuca, Mex., north about 250 miles to Tampico, to connect with its other line, the Monterey & Mexican Gulf. When completed this would make a through line from northern Mexico to the capital city. (Sept. 1, 1899, p. 619.)

IDAHO SOUTHERN.—This company was incorporated in New Jersey, May 4, with a capital stock of $5,000,000, to build a railroad in Idaho from Garlington south 150 miles to connect with the Southern Pacific. The Idaho Development Co., incorporated at the same time with a capital stock of $500,000, is the constructing company. The incorporators are: James W. Adair, E. S. Jacob and Harry S. Baltz, all of Jersey City, N. J.

LOUISVILLE & NASHVILLE.—A new survey is ordered for the Northern Alabama line from Pheians, to run south about 74 miles to Bessemer. (March 30, p. 210.)

Grading is reported begun on the extension from Pineapple, Ala., to Camden, 16 miles. The company has also let a contract for $100,000 work on the road from Pineapple to Selma.

MASSENA TERMINAL.—This company was incorporated in New York, May 2, with a capital stock of $250,000, to build a steam road two miles long in St. Lawrence County, from Massena Springs north

to a point near the power house of the St. Lawrence Power Co. The Directors are: William F. Zemmerman, Thomas H. Gillespie, Charles R. Hebard, F. J. Gableman, William K. Archbold, Frank Townsend, William B. Wreaks, E. W. T. Gray and Robert A. Johnston, of New York City.

M'CLOUD RIVER.—The proposed extension is from McCloud, Cal., east, about 20 miles to Bartles, which is in the direction of Alturas, and only 15 or 20 miles from Fall River. Surveys are in progress and the company expects to do the grading this year, but it is not intended to lay rails until next spring. (April 27, p. 280.) The extended line will probably be bonded the same as the original line from Upton to McCloud at $12,000 per mile. (Official.)

MISSOURI PACIFIC.—Work is in progress, according to report, on a cut-off from Cornell, Kan., to run southeast about 25 miles to Webb City, Mo., to give a short cut into the Joplin zinc district.

MONTANA.—Preliminary surveys are made for a line from Dorsey, Mont., via White Sulphur Springs to Copperopolis, but there is no definite intention at present of building. The whole question hinges on the development of certain mining properties in the Copperopolis district which are not sufficiently advanced at present to warrant consideration of building. (Official.)

NASHVILLE, CHATTANOOGA & ST. LOUIS.—An officer writes that the company is thinking of building an additional line from Hickman, Ky., but nothing definite is determined. (April 27, p. 280.)

NEVADA - CALIFORNIA - OREGON.—This company, which has completed an extension from Amadee, Cal., north 50 miles to Termo, proposes, according to report, to build 40 miles more this year. The road is surveyed north about 110 miles via Alturas to Lakeview, Ore. (Dec. 22, 1899, p. 880.)

NEW YORK & LONG ISLAND.—See "Certain Connecting Railroads in New York City," in another column.

NEW YORK CONNECTING.—See "Certain Connecting Railroads in New York City" in another column.

NEW YORK, ONTARIO & WESTERN—Arrangements are being completed, according to report, for building the Kingston & Roundout Valley road, which is practically an extension from Ellenville, N. Y., northeast about 35 miles to Kingston. It would parallel in part the proposed Delaware Valley & Kingston. (See above.)

NORTHERN PACIFIC.—The company is to build a line from Casselton, N. D., southwest 60 miles to a point in La Moure County, in Section 10, Township 136, North, Range 61. The location of intermediate stations is not yet determined. The contract for building the entire line is awarded to Foley Bros. of St. Paul, who have just begun work. Where the line crosses the Sheyenne Valley the work is quite heavy. The rest of the line is of ordinary prairie construction. The maximum grade is 1 per cent., and the maximum curve 5°. (April 20, p. 263.)

Regarding the extension from Milnor, S. D., to Oakes, 32 miles, the work is contemplated, but the contract is not yet let. (Official.)

OMAHA NORTHERN.—This company, which proposes to build from Sioux City, Ia., south about 92 miles to Omaha, Neb., is reported to have obtained entry into Sioux City over the tracks of the Willmar & Sioux Falls line of the Great Northern. It is understood that building is to be begun about June 1. A. S. Churchill of Omaha, Neb., is President. (March. 9, p. 161.)

OREGON RAILROAD & NAVIGATION.—The Portland, Ore., Board of Trade is seeking right of way for a proposed extension north down the Willamette River to St. Johns.

OREGON SHORT LINE.—An officer writes that the company will lay approximately 60 miles of 70, 80 and 85-lb. rails north of Pocatello, Id., and will widen the embankments and distribute gravel ballast on about 90 miles of roadbed in various places north and east of McCammon. (April 27, p. 280.)

PASCAGOULA & NORTHERN.—Surveys are reported in progress for this proposed line from Pascagoula, Miss., to New Albany, about 275 miles. J. W. Stewart, of Pascagoula, Miss., is President. (March 16, p. 178.)

PENNSYLVANIA.—Building is reported begun on the branch from Queen's Run, Pa., on the south side of the Susquehanna River, to run west to the mouth of Tangascootac Creek. (April 27, p. 280.)

Bids are asked for the extension from Mt. Etna, Pa., terminus of the Mt. Etna branch, to run east about nine miles to Petersburg, on the main line. (May 4, p. 296.)

PENNSYLVANIA & NORTHWESTERN.—An officer denies the report that a branch will be built from Hillman, Pa., north 15 miles via Big Run to Falls Creek on the Pennsylvania. (April 27, p. 280.)

PITTSBURGH, BESSEMER & LAKE ERIE.—A letter from the Chief Engineer states that some preliminary lines have been run to see what can be done to improve the alignment and grade at Shenango Hill, Pa., but the matter is not sufficiently advanced to give further information. (April 27, p. 280.)

PORTLAND, VANCOUVER & YAKIMA.—Surveys are reported in progress on an extension of this line from Salmon Creek, Wash., northeast about 30 miles to the falls of the Lewis River. It is stated that grading and track laying will be begun very soon. (Feb. 23, p. 128.)

SANTA FE & ARIZONA SOUTHERN.—Grading is reported in progress for this line from Seligman, Ariz., on the Atchison, to run south 80 miles into the copper district. At a meeting of the stockholders, held at Los Angeles, Cal., April 24, Wm. F. Botsford was elected President; Edward J. Carter, First Vice-President and General Manager, and James C. Talmadge, Secretary and Treasurer, all of Los Angeles.

SOUTHERN PACIFIC.—A branch of the Sonora is to be built, according to report, to the recently discovered natural coke deposits near La Barranca, State of Sonora, Mexico.

Grading is reported begun on the proposed extension from Wharton, Tex., southeast 30 miles along Caney Bayou. (Nov. 24, p. 820.)

SUNSET.—Locating surveys are completed for this line from Bakersfield, Cal., on the Southern Pacific, southwest 39 miles via Gosford and Lakeside to Sunset. The officers are ready to receive bids for grading and track laying. The contract for the rails is reported virtually let. It is stated that building is to be begun before June 1. C. M. Beal of Bakersfield is President, and J. L. Browne, Chief Engineer. (April 13, p. 246.)

TEXAS, SABINE VALLEY & NORTHWESTERN.—Surveys are reported completed for an extension from Timpson, Tex., south about 40 miles to San Augustine, to connect with the proposed extension of the Gulf, Beaumont & Kansas City.

WESTERLY & JEWETT CITY.—An act amending the charter of this company has been introduced into the Rhode Island House of Representatives. It proposes to extend the time for completing the road to Oct. 1, 1901. This is an old project under an incorporation made in 1893. The first survey was made in 1889. J. A. Young of Griswold, Conn., was an incorporator. The line is projected from Westerly northwest 20 miles via Voluntown, Conn., to Jewett City. (April 7, 1899, p. 254.)

WEST VIRGINIA ROADS.—The Dumps Creek Railway & Mining Co., recently incorporated in West Virginia, proposes to build a railroad about eight miles long from its mines to the Norfolk & Western. J. Yosh, of Staunton, Va., is President.

YELLOW RIVER.—Contracts are about to be let, according to report, for the Florida, Alabama & Northern extension from Florala, Fla., northeast 50 miles via Elba to Troy, Ala. W. B. Wright, of Pensacola, Fla., is President. (April 13, p. 246.)

GENERAL RAILROAD NEWS.

BANGOR & AROOSTOOK.—The company has negotiated the sale to Brown Bros. & Co., Lee, Higginson & Co., and Maitland, Coppell & Co., of $1,000,000 5 per cent. 10-year car trust notes, payable at the rate of $50,000 semi-annually. The company has just placed an order with the American Car & Foundry Co. for 1,616 flat box and stock cars, to meet which this issue is made. (April 14, p. 273.)

BIRMINGHAM BELT.—The stockholders on May 5 voted to issue $1,500,000 bonds, the proceeds of which, it is stated, are to be used for improvements and new equipment. (April 13, p. 246.)

CENTRAL OF NEW JERSEY.—The refunding of the $11,500,000 consolidated 7 per cent. bonds of the Lehigh & Wilkesbarre Coal Co., maturing June 1, will be through the extension of the bonds for 10 years at 4½ per cent., the principal and interest to be guaranteed by the Central of New Jersey. The entire issue has been subscribed for, but present holders have the privilege between May 10 and 21 of exchanging their holdings for the new bonds and receiving at the same time payment of the June coupon. An additional $500,000 of the bonds will be sold, the proceeds from which will be used to retire real estate mortgage bonds for a like amount maturing June 1. Of the entire issue, $5,884,000 will then be in the hands of the public, and $6,116,000 in the treasury of the C. of N. J. (May 4, p. 296.)

CHESAPEAKE & OHIO.—The company has made a five-year car trust for $1,162,356, covering 597 flat bottom and 901 hopper bottom cars furnished by the Pullman Co.

CHICAGO & ALTON.—The new company has made a mortgage to the Farmers' Loan & Trust Co. as trustee, to secure $22,000,000 bonds. This loan is independent of the $40,000,000 new refunding 3 per cent. bonds, of which $32,000,000 is subscribed and the balance cancelled. (April 20, p. 264.)

Announcement is made of a dividend of 30 per cent. on the stock of the old company.

CHICAGO, BURLINGTON & QUINCY.—The company has set aside $294,410 as a sinking fund to buy C., B. & Q. Nebraska extension 4 per cent. bonds due May 1, 1927, at a price not to exceed 110 and accrued interest. Proposals will be received by the New England Trust Co., Boston, until May 15 at 12 noon. (Jan. 26, p. 64.)

CHICAGO JUNCTION RAILWAYS & UNION STOCK YARDS.—Strong, Sturgis & Co., New York, and Lee, Higginson & Co., Boston, are offering $2,000,000 of the $4,000,000 issue of 4 per cent. 40-year mortgage and collateral trust refunding gold bonds at 99 and interest. The remaining $2,000,000 has been sold. The proceeds are to be used to retire $2,465,000 5 per cent. income bonds, and $400,000 5 per cent. notes, and to provide cash for improvements, including additional abattoirs, packing houses, etc. These firms offer to exchange the old securities for the new on the basis of 100 and interest, the difference to be adjusted in cash, payment and delivery to be made on or before June 30. Notice is also given that interest is to cease on the old securities after July 1. (March 16, p. 178.)

CHICAGO, WEST PULLMAN & SOUTHERN.—An officer writes that the company has not passed under the control of the Chicago Terminal Transfer, as reported, but that that company has leased the tracks and will operate them for the present. The C., W. P. & S. will continue, as before, without change of officers. (C. T. T., April 20, p. 264.)

CHOCTAW, OKLAHOMA & GULF.—A circular has been issued to the stockholders of this company stating the terms on which the Choctaw & Memphis is to be taken over. One share of the C. & M. preferred and $5 in cash is to be exchanged for one share of the preferred of the C., O. & G. Five shares of the C. & M. stock is to be exchanged for three shares of the C., O. & G. stock. The C. & M. stock consists of $1,750,000 preferred and an equal amount of common. (May 4, p. 296.)

DELAWARE RIVER.—The West Jersey & Seashore Co. is reported to have bought the entire capital stock and bonds of this company. The line runs from Woodbury, N. J., to Penn's Grove, 19.97 miles. (Feb. 16, p. 112.)

LAKE TAHOE RAILROAD & TRANSPORTATION.—Press reports from California state that Wm. S. Tevis has bought a controlling interest in this property from D. L. Bliss of Carson, Nev. The road runs from Truckee, Cal., south 15 miles to Tahoe City, and was completed last year. It is to be operated for the first time this summer. (Railroad Construction column, Sept. 1, 1899, p. 619.)

MISSOURI, KANSAS & TEXAS.—Forty-eight bonds of the Booneville Bridge Co. have been drawn for the sinking fund for payment at the Union Trust Co., New York, trustee, interest to cease July 1. (Jan. 19, p. 48.)

MISSOURI PACIFIC.—F. J. Lisman & Co., New York, offer for sale at 90 and interest $100,000 Leroy & Caney Valley Air Line first mortgage 5 per cent. gold bonds of 1926. These bonds are guaranteed principal and interest by the M. P.

MOBILE & OHIO.—More than a majority of the holders of St. Louis & Cairo stock have accepted the offer to exchange for new M. & O. collateral trust bonds and formal notice is given that the offer to exchange will remain in force until Aug. 1. (March 22, p. 194.)

OMAHA & ST. LOUIS.—The committee composed of W. Emlen Roosevelt, Cornelius B. Gold and Francis Smith gives notice to holders of first mortgage bonds that default having occurred in the interest of these bonds, due Jan. 1, and the receivers of the property having procured from the court leave to use $525,000 of prior lien receivers' certificates, the committee has become entitled to a controlling interest in the stock and has taken proceedings to enforce the agreement and protect the rights of the bondholders. Bondholders are requested to deposit their bonds under an agreement that has been prepared, with the Union Trust Co., New York. (Kansas City, Pittsburgh & Gulf, May 4, p. 296.)

PEORIA, DECATUR & EVANSVILLE.—The directors have issued a statement in the interest of the stock and the minority second mortgage bonds, maintaining that the foreclosure proceedings were fraudulent. The appeal from the foreclosure decree will be argued during June before the United States Circuit Court of Appeals. (May 4, p. 296.)

PHILADELPHIA & READING.—General mortgage bonds to the face value of $433,000 have been bought from the sinking fund and application is made to the New York and Philadelphia Stock Exchanges that they be stricken from the list. Under the terms of the general mortgage before declaring a dividend on the preferred stock the company must set aside for the sinking fund a sum equal to 5 cents a ton on all coal mined by the company during that year. (Feb. 16, p. 112.)

SAGINAW, TUSCOLA & HURON.—The stockholders at the annual meeting on May 1 confirmed the lease of their property to the Pere Marquette. The lease is to run for 999 years from Feb. 1. The principal and interest of $1,000,000 4 per cent. bonds of the leased road and the maintenance of the property is guaranteed. (Feb. 16, p. 112.)

ST. PAUL & DULUTH.—Official announcement is made that the Northern Pacific has made a contract to buy all interest in the syndicate organized last December by Clarence S. Day & Co., which acquired a majority of the $4,660,287 common stock at $50 per share. The syndicate proposed through the purchase of all the company's lands to take up and cancel the preferred stock of $3,895,030, and this will be carried out by the Northern Pacific. The land has been sold and the directors have deposited the money with J. P. Morgan & Co., which firm will on and after May 15 pay to holders the par value of the certificates of preferred stock, together with the dividend of 3½ per cent., upon surrender of the same. These preferred shares will cease to have voting power and the right to further dividends after July 1. The stockholders will vote May 31 upon a proposition to sell the road and its franchises. A change has been made in the directorate to give representation to the Northern Pacific. (May 4, p. 296.)

SEABOARD AIR LINE.—The Florida Central & Peninsular on May 3 gave formal notice to the Southern Ry. that on and after May 10 it would discontinue the use of the track, bridge and terminals of that company at and near Columbia, S. C. It has been using these terminals pending the completion of the new connecting link and bridge across the Congaree River at Columbia between the F. C. & P. and the Seaboard Air Line. Track laying is completed on the Richmond, Petersburg & Carolina connecting line and the Seaboard Air Line is soon to institute through train service between New York and Tampa, Fla., using its own tracks from Richmond. (May 4, p. 296.)

TALBOTTON.—Edgar T. Smith, of Talbotton, Ga., on May 3 was appointed temporary receiver. The hearing has been set for May 19, before Judge W. B. Butts, at Columbus, Ga. The road runs from Talbotton to Bostwick, seven miles. (Sept. 29, 1899, p. 686.)

UNION PACIFIC.—At the request of John F. Dillon, solicitor for the receivers, Judge Lacombe on May 8 discharged the receivers. (Nov. 10, 1899, p. 788.)

VICKSBURG, SHREVEPORT & PACIFIC.—The appointment of the receiver was made at the instance of the trustees of the company's third mortgage to frustrate the original suit, and to bring about a settlement of the affairs of the company without impairing the value of the property. (May 4, p. 296.)

WHEELING & LAKE ERIE.—The refunding plan for exchanging the divisional 5 per cent. bonds for new consolidated mortgage 4 per cent. bonds and the preferred stock has been matured, subject to approval by the foreign interests. Under this plan the bonds for $1,000 each will be exchanged as follows: Lake Erie Division first mortgage will receive $1,000 in 4 per cent., $300 in first preferred, and $150 in second preferred stock. Wheeling Division first mortgage bonds, the extension and improvement bonds, and the Toledo Belt Railway first mortgage bonds, will each receive $1,000 in 4 per cents., $200 in first preferred and $100 in second preferred stock. (Aug. 4, 1899, p. 562.)

WISCONSIN CENTRAL.—The company has made a mortgage to the Minneapolis Trust Co., as trustee, to secure $500,000 of 3 per cent. 50-year bonds, dated Jan. 1, 1900, subject to call after Jan. 1, 1910, at 105. The mortgage is on the recently bought terminal property at Minneapolis. (April 27, p. 280.)